Immunization Registry Operational Guidelines Evaluation

Final Report

Submitted by

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EXECUTIVE SUMMARY

The Modeling of Immunization Registry Operations Work Group (MIROW), formed in 2005 by the American Immunization Registry Association (AIRA) in partnership with the Centers for Disease Control and Prevention (CDC), has created a series of best practice operational guidelines for immunization information systems (IIS).[1] The MIROW guidelines promote consistent operational practices across state and local IIS. The objective of this evaluation was to assess the degree to which the first three MIROW guides have impacted IIS operations:

- *Management of Moved or Gone Elsewhere (MOGE) Status and Other Patient Designations in IIS* (2005);
- *Vaccination Level Deduplication in Immunization Information Systems* (2006); and
- *Data Quality Assurance in IIS: Incoming Data* (2008).

Methods

The evaluation was conducted two phases to ensure that a comprehensive perspective of MIROW guide use and impacts was obtained.

A **broad evaluation** was conducted to assess the MIROW guideline use across a wide range of MIROW recommendations and a comprehensive sample of state and local IIS. We conducted semi-structured telephone interviews with IIS program managers in the 50 states and the 4 metropolitan areas with independent IIS (District of Columbia; New York, NY; Philadelphia, PA; and San Antonio, TX). Overall, we completed interviews with 45 (83%) of these programs in Fall 2013 (see Appendix A for a list of participating programs and Appendix B for the broad evaluation interview guide). We also conducted interviews with a subset of IIS vendors representing the majority of IIS systems.

An **in-depth evaluation** was employed to assess the impacts of guide use and key MIROW guideline recommendations in greater detail. The in-depth evaluation was completed among a subset of IIS using information gathered using two complementary approaches:

- An online survey was conducted to assess the impacts of guide use among "direct" users of at least one guide. Two versions of the online impact survey were fielded in Spring 2014 based on different levels of direct use of the guides; one version was for IIS programs that reported directly using at least one of the guides such that a change was made to IIS functionality or business processes (see Appendix D), and the other addressed more general impacts (see Appendix E).
- In-depth interviews were conducted with 7 IIS programs in Spring 2014 to fill any gaps from the broad evaluation interview and obtain a clearer understanding of IIS operational consistency with the MIROW guides and on impacts of using the guides.

Our main focus was on "*direct use*", which we defined as being demonstrated applications of a MIROW guide, and classified into several categories, such as implementing changes to an existing IIS and planning for a new IIS. Where possible, we also classified "*indirect use*" by IIS programs. Indirect use was attributed to an IIS if the IIS program indicated that the IIS has features consistent with MIROW guide recommendations that pre-date the guide, or at least their review of the guide. In addition, indirect use was attributed to an IIS if an IIS vendor indicated that their system has features consistent with MIROW guide recommendations and that these features are integrated into their product such that all of their clients use those features.

[1] http://www.immregistries.org/resources/aira-mirow

Note that an IIS program could have both direct and indirect use. For example, an IIS program may have had some of the incoming data quality business rules in place prior to development of the Incoming Data Quality Guide (i.e., indirect use), but may have directly used the guide to add some additional incoming data quality checks. We also report overall use for each guide, which combines direct and indirect use and includes those with direct use only, indirect use only, and both direct and indirect use.

Some important limitations of this approach should be considered in conjunction with our findings. Semi-structured interviews with current IIS staff were the primary means of data collection. The broad or in-depth evaluation interviews may not have fully covered all aspects of MIROW guide use for a particular program. Also, the self-report of current IIS staff may be impacted by recall bias and by transitions in IIS staff and IIS systems that have occurred since the guides were published.

Findings

Among the 45 IIS programs that participated in the broad evaluation interview, most reported familiarity with each of the three MIROW guides, most commonly for the Vaccination-Level Deduplication Guide (87%) followed closely by the Patient Status Guide (84%) and to a lesser degree the Incoming Data Quality Guide (78%).

Of the 45 IIS programs, 32 (71%) reported direct use of one or more of the three guides, with 13 programs reporting no direct use of any of the three guides or not knowing whether the guides had been directly used due to a recent IIS manager transition. The Patient Status Guide had the highest level of direct use (64%), followed by the Incoming Data Quality Guide (58%) and the Vaccination-Level Deduplication Guide (56%). Among the 32 direct users, 18 IIS programs directly used all 3 guides, 12 used 2 guides, and 2 used 1 guide. Types of direct use ranged from having the guides available as a reference on best practices to implementing changes to the IIS that align with these best practices.

Most guide use has occurred in the past few years, which may be partly a function of IIS maturity, as many programs have transitioned to new systems in recent years, and a growing awareness of the MIROW guides, based on dissemination efforts of AIRA and the MIROW Steering Committee. Many programs have a general idea of the extent to which their IIS is consistent with the guides, but few have formally assessed the extent of guide implementation.

Indirect use was attributed to 10 programs for the Patient Status Guide, 23 programs for the Vaccination-Level Deduplication Guide, and 20 programs for the Incoming Data Quality Guide. Looking at overall use (i.e., direct and indirect use combined) for the 45 programs, 73% used the Patient Status Guide (n=33), 82% used the Vaccination-Level Deduplication Guide (n=37), and 76% used the Incoming Data Quality Guide (n=34).

<u>Factors Affecting Guide Use</u>

Direct use of the MIROW guides was found to be influenced by several factors, both internal and external to IIS programs. The maturity of an IIS program and systems' life cycle stage were often the impetus to employ the guides; an impending enhancement to an existing system, or the procurement process for a new system were often key trigger events. Procuring or developing a new IIS platform provides an ideal opportunity to obtain a product that is, by design, consistent with the guides. In contrast, long-standing IIS programs need to determine in what ways their IIS differs from best practice, determine what is feasible to change in their IIS, and then adapt their systems to include new functionality or business processes.

Importantly, the influences of the Meaningful Use incentives to encourage the wide adoption of electronic health record (EHR) systems were evident among many IIS programs. The potential benefits and challenges of EHR/IIS interoperability were widely reported as a driver behind data

quality and business process concerns that were addressed by MIROW guide use. Although data quality was a key theme, the reported uses influenced by interoperability considerations involved each of the guides. Absent an impending need to modify or replace an IIS system, programs frequently referred to the MIROW guides as a best practices reference upon which their systems could be gauged.

Barriers to Use

IIS programs frequently described barriers to guide use; most often, the leading barriers were rooted in the pressures of competing IIS program priorities and the reality of resource and staff limitations. Much IIS funding is through federal grants and therefore priorities are often driven by grant requirements or other major initiatives. Recently, these activities include recording dose-level VFC eligibility status, deploying CDC's Vaccine Tracking Systems (VTrckS), and addressing providers' interest in meeting Meaningful Use requirements. Note that the emphasis placed on meeting Meaningful Use objectives has greatly increased interest in reporting electronically to IIS, which could trigger increased use of the Incoming Data Quality Guide. However, Meaningful Use activities also may require significant staff time and resources, which may detract from other IIS priorities or uses of the guides.

It is important to note that adopting functionality consistent with the guides can at times be in conflict with programmatic priorities. For example, IIS programs reported that implementing some of the data quality business rules could hinder provider onboarding, either by slowing down the process or reducing the number of organizations or EHRs that are able to meet those rules. IIS-related policies and laws can also affect the ability of an IIS program to implement certain components of the guide. In cases where provider reporting is not required, or patients must opt in to be included in the IIS, data completeness is often a major concern. For these programs, programmatic priorities tend to focus more on ways to increase the quantity of data reported to the IIS, and the more asked of providers for reporting data, the less likely they may be to report at all.

Degree of IIS Vendor Involvement

The level of IIS vendor involvement varies across IIS programs and also may affect guide use. For in-house systems, IIS development and maintenance is done by internal staff, and any use of the guides must be self-initiated. On the other end of the spectrum, an IIS vendor that provides a standardized product across its clients takes on much of the responsibility to align its product with best practices. Individual programs using IIS products such as these should still be encouraged to familiarize themselves with the guides, as some of the best practices pertain to business processes that are not under the IIS vendor's control (e.g., provider use of patient status fields). In another variation, IIS vendors provide a base product to their clients, who have significant ability to customize the product, either themselves or by the IIS vendor. Though MIROW consistent functionality may be incorporated into the IIS vendor product to some degree, use of these functions varies across programs. Changes can be shared across users but are not always adaptable based on IIS-specific variations in the product that have been implemented over time.

Impacts of Guide Use

Among direct users, the guides were widely considered to be helpful. Through the impact surveys and interviews, guide use was reported to have a range of positive impacts, including positive impacts on implementation of guide-specific concepts (e.g., capturing patient status, developing an algorithm for deduplicating vaccine events) to more downstream positive impacts on data quality. Positive impacts on overall understanding of best practices related to the guide topics were also noted. A few negative impacts of guide use were raised, mainly related to the amount of time or resources initially needed to implement changes related to the guides. Among IIS programs that were able to address the question, many felt that the guides had no direct financial impact on their program or they were unsure about any financial impacts.

Improved Data Quality. A fundamental requirement for IIS is to maintain timely, accurate, and complete vaccination data. The essential IIS functions of vaccination surveillance (e.g., assessment) and outreach (e.g., reminder/recall) cannot be achieved without adequate data quality across these dimensions. Toward that goal, IIS programs reported numerous advantages to MIROW guide use that pertains to improved data quality across a wide range of perspectives. While the Incoming Data Quality Guide is directly aimed at processes to prevent data quality issues, both the Patient Status and Vaccination-Level Deduplication Guides can also have direct, positive impacts on the accuracy of IIS data.

Reduced IIS Staff Time. Users of the MIROW guides also reported clear advantages to not "reinventing the wheel"; MIROW business processes could be directly adopted or modified as needed, which resulted in reduced IIS staff time. The benefits described by MIROW guide users include providing IIS programs with best practice-based processes and the corresponding time savings from avoiding staff labor devoted to created MIROW-supplied algorithms. Providing IIS programs with the detailed models to develop the necessary patient status categories, deduplication algorithms, and data quality assurance tools can save staff time not only for IIS development efforts, but program operations as well. MIROW guide users report reduced IIS staff burden for resolving data quality problems as well as for reconciling data with providers. These benefits will potentially have far-reaching consequences as initiatives such as EHR interoperability continue to expand and new provider sites come online for electronic data reporting.

Efficiencies Across IIS Programs. There are also clear benefits nationally when aggregating the efficiencies experienced by individual IIS. As a whole, such efficiencies translate into cost avoidance and redundant efforts across IIS programs can be minimized. This is achieved across IIS programs since fewer IIS staff are needed to write requirements for IIS procurements or create processes that have already adopted by MIROW as a best practice. MIROW best practices are clearly aimed at maximizing data quality, which can further avoid devoting staff time to correcting data problems.

Conclusion

Overall, most IIS programs were familiar with the first three MIROW guides published and the majority have been able to directly use one or more of these guides. Types of direct use ranged from prompting changes to an existing IIS to helping develop provider education materials. Direct users generally considered the guides to be helpful and reported many positive impacts from use of the guides. Although guide use was generally high, some barriers to use were reported. Next steps could include developing strategies to address barriers to guide use and to further disseminate MIROW-based best practices in "user friendly" formats.

1.0 INTRODUCTION

The Modeling of Immunization Registry Operations Work Group (MIROW), formed in 2005 by the American Immunization Registry Association (AIRA) in partnership with the Centers for Disease Control and Prevention (CDC), has created a series of best practice operational guidelines for immunization information systems (IIS).[2] The MIROW guidelines promote consistent operational practices across state and local IIS. For this study we evaluated the use and impact on IIS operations of the following three MIROW guides:

- *Management of Moved or Gone Elsewhere (MOGE) Status and Other Patient Designations in IIS* (2005);
- *Vaccination Level Deduplication in Immunization Information Systems* (2006); and
- *Data Quality Assurance in IIS: Incoming Data* (2008).

The objective of this evaluation was to assess the degree to which these MIROW guides have impacted IIS operations.

2.0 METHODS

This evaluation was conducted in coordination with the MIROW Steering Committee, which reviewed key components of the evaluation approach and provided feedback. We conducted this evaluation in two phases:

1. a broad evaluation, aimed at assessing the MIROW guidelines across a wide range of MIROW recommendations and a comprehensive sample of state and local IIS. This analysis was intended to provide a general sense of use of the three MIROW guides and IIS functionality related to the three guides.
2. an in-depth evaluation, aimed at assessing a subset of key MIROW guideline recommendations in greater detail among a subset of IIS and the impacts of guide use.

2.1 Broad Evaluation

A protocol was developed to assess use of the three MIROW guides considered in this evaluation. These guides were reviewed and served as the basic framework for the development of our evaluation approach. The broad evaluation process was conducted using semi-structured telephone interviews with IIS program managers, IIS vendor interviews, and collection of IIS background information. In addition, other key documents and reference data were obtained to furnish additional context pertaining to MIROW guide use, such as Immunization Information System Annual Report (IISAR) information from the years 2007-2012.[3]

Study Population

The study population was the 50 states and the 4 metropolitan areas with independent IIS (District of Columbia; New York, NY; Philadelphia, PA; and San Antonio, TX) that receive CDC funding support through the federal Section 317 and Vaccines for Children (VFC) programs (i.e., “awardees”). The 10 remaining awardees (8 island awardees and 2 city awardees that use their state IIS) were not included in this study.

IIS Profiles

In advance of the broad evaluation interview, a profile was created and sent via email to each IIS program. Participants were asked to review and verify the profile during their scheduled interview. Profiles included ages included in the IIS, IIS vendor platform and support, history of recent IIS vendor/platform changes, ability to send and receive HL7 version 2.3.1 and 2.5.1 messages, consent policies, and the degree to which provider reporting to the IIS is mandated.

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[2] http://www.immregistries.org/resources/aira-mirow

5[3] http://www.cdc.gov/vaccines/programs/iis/annual-report-IISAR/index.html

We also documented involvement by the IIS jurisdiction in development of the three MIROW guides being evaluated, the MIROW Steering Committee, and other CDC-funded, IIS-related initiatives. Finally, we included 2012 IISAR data regarding IIS participation for children, adolescents, and adults.

IIS Vendor Data Collection

A subset of IIS vendors (Avanza, Envision, HLN, HP, STC), representing the majority of IIS systems, were contacted to collect general information on the IIS jurisdictions that use their product(s), and the process and degree to which MIROW guidelines may have been incorporated into their IIS product. These data were collected mainly through one or more telephone interviews, with email follow-up as needed, from July 2013-May 2014.

Broad Evaluation Interviews

IIS program managers were invited via email to participate in the broad evaluation interview, and interviews were scheduled for a 60-minute block of time. Overall, we completed interviews with 45 (83%) of these programs in Fall 2013 (see Appendix A for a list of participating programs). Note that at the time of this study, one program was in the process of IIS procurement and was consequently unable to respond to many of the broad evaluation questions; in these cases, results are reported for 44 respondents. Telephone interviews were audio recorded and subsequently transcribed to facilitate identification of key themes. During the interview, information from the IIS profile was verified and additional background information was collected, such as the number and experience of IIS staff, IIS implementation year, and whether there are any major changed planned in IIS vendor or platform. For a few programs with a recent IIS manager transition, we interviewed the former IIS manager. Follow-up questions were sent by email in some cases. See Appendix B for the broad evaluation interview guide.

An important aspect of the interview was to capture MIROW guide-specific information on familiarity with each guide and the degree to which the guide was used with their respective IIS. Our main focus was on “direct” use, which we defined as being demonstrated applications of a MIROW guide, and classified into several categories:

- **Implementing changes to existing IIS**: identifying and implementing IIS functionality or business process changes pertaining to the guide;
- **Planning future improvements to existing IIS**: establishing directions or plans for future improvements to the IIS;
- **Planning for new IIS system**: using the guide to plan for a new IIS, including working into language for a statement of work (SOW) or a request for proposal (RFP) for procurement of a new IIS;
- **Using as an internal reference**: using as an internal reference for best practices related to the guide, without making changes to the IIS, such as using as staff orientation materials or to prepare for a CDC site visit; and
- **Developing provider education materials**: creating or revising training and education materials for providers.

If a guide was determined to have been directly used, we explored several aspects of use, including the extent to which the guide was helpful, and whether the guide was used for a new or an existing IIS. We also explored the timing of the guide use (e.g., when, duration of use, one-time use or incremental use) and whether any future use was planned. In addition, the interviews explored general functionality and processes in the IIS pertaining to each of the three MIROW guides, as summarized in Table 1. This information was further supplemented with information available online, such as a description of the patient status field in IIS user guides.

Table 1: MIROW Guide-Related Functionality Considerations

Patient Status

- whether patient status is recorded at the provider level;
- the extent to which patient status is available at the geographic/jurisdictional level;
- the categories used to define patient status in IIS;
- whether providers are given instructions regarding use of patient status;
- whether rules/logic exist for which patient status designations should be included in reminder/recalls and coverage assessments; and
- whether IIS-based reminder/recall is done by providers and/or centrally.

Vaccination-Level Deduplication

- whether there are rules/logic in place to identify and resolve duplicate vaccinations;
- the existence of an automated algorithm for de-duplicating vaccines;
- the extent to which vaccination de-duplication is done manually and whether metrics are tracked;
- the maximum time window for selecting potential duplicates (e.g., 23 days);
- whether the "best" record is kept, or consolidated/merged record when duplicates resolved; and
- whether audit trails are in place so that vaccination deduplication can be reversed.

Incoming Data Quality

- whether a process for "pre-certifying" electronic data submitters exists;
- the degree to which rules/logic exist for ongoing data quality checks that are run before data are loaded into the IIS;
- whether an automated DQA tool is currently used;
- the extent to which data for direct enterers is tested prior to "live" entry;
- whether automated edit checks exist for direct enterers; and
- whether routine data checks are conducted after data have been entered.

Where possible, we also classified “indirect” use by IIS programs. Indirect use was attributed to an IIS if the IIS program indicated that the IIS has features consistent with MIROW guide recommendations that pre-date the guide, or at least their review of the guide. (These programs were often involved in the development of the relevant MIROW guide based on their experiences.) In addition, indirect use was attributed to an IIS if an IIS vendor indicated that their system has features consistent with MIROW guide recommendations and that these features are integrated into their product such that all of their clients use those features. The features could be consistent with the MIROW guides due to direct use of the guides by the IIS vendor or existing functionality that pre-dates the guides.

Where IIS vendors indicated that there are features consistent with the MIROW guides in their products, but that implementation or use of these features could vary across their clients, indirect use was not attributed to those IIS programs unless it was also noted by the IIS program in the broad evaluation interview, or confirmed in the in-depth interviews, where applicable.

Note that an IIS program could have both direct and indirect use. For example, an IIS program may have had some of the incoming data quality business rules in place prior to development of the Incoming Data Quality Guide (i.e., indirect use), but may have directly used the guide to add some additional incoming data quality checks. We report overall use for each guide, which combines direct and indirect use and includes those with direct use only, indirect use only, and both direct and indirect use.

2.2 In-Depth Evaluation

The in-depth evaluation was accomplished in two parts: (1) a survey on impacts of guide use among a subset of IIS programs; and (2) in-depth interviews with a smaller subset of IIS programs.

Study Population

For the in-depth evaluation, the study population excluded the IIS programs that were not part of the broad evaluation, i.e., the 8 island awardees, the 2 city awardees that use their state IIS, and the 9 IIS programs that did not complete a broad evaluation interview. Of the remaining 45 IIS programs, candidates for the in-depth evaluation were restricted to those that reported direct use of at least one of the guides (n=32), to focus on programs believed to have a richer set of experiences related to the MIROW guides and issues related to their application.

We further excluded 3 programs because the person interviewed for the broad evaluation was a former IIS manager. Although this person was familiar with the program's use of the guide and willing to participate in the broad interview, we felt it appropriate to exclude them from further data collection given the time elapsed since the broad evaluation interview and the fact that this contact no longer had IIS manager responsibilities. Therefore, 29 IIS programs were eligible for the impact survey and in-depth interviews.

Of these 29 programs, 8 IIS programs were chosen as an initial set of in-depth interview candidates to (1) reflect variability in IIS platform/vendor support, so that the three major IIS vendors and a subset of the smaller IIS vendor and in-house systems were represented; and (2) focus on those not affected by very recent or upcoming major IIS platform or staff transitions.

Impact Surveys

The purpose of the impact survey was to assess IIS programs' perspective on the extent to which direct use of a guide had various impacts. Based on different levels of direct use, two different online survey instruments were developed in SurveyMonkey®. One version was for IIS programs that reported directly using at least one of the three guides such that a change was made to IIS functionality or business processes, including all of the in-depth interview candidates. These IIS programs received a 62-question survey, with a section for each guide, asking about specific impacts such as "The amount of time spent by your program to reconcile duplicate vaccinations in your IIS" (see Appendix D). We sent 17 programs an email invitation to this survey, and received a returned email from one program indicating a recent IIS manager transition; therefore, there were 16 potential respondents to the "detailed" impact survey.

The other version of the survey included 24 questions addressing more general impacts (see Appendix E), such as "Your program's understanding of best practice guidelines related to patient status". This survey was intended for programs whose direct use did not lead to changes in their IIS, such as those that used the guide to identify changes they hope to make to their IIS in the future. We sent 12 programs an email invitation to this survey, and received a returned email from one program indicating a recent IIS manager transition; therefore, there were 11 potential respondents to the "general" impact survey.

For each question on both surveys, respondents were asked to rate the impact of guide use on a scale from "Substantial Positive Impact" to "Substantial Negative Impact"; both positive and negative impacts could be specified for the same question, or "Don't Know" or "Not Applicable" could be specified. Survey invitations were sent via email to the person(s) who participated in the broad evaluation interview; responses could be entered online or into a pdf file and emailed back to us. Note that these IIS programs had indicated direct use of at least one, but in most cases not all, of the guides in the broad evaluation interview. Respondents were asked to respond to questions only for the guide(s) for which they had indicated direct use in the broad evaluation interview. Both surveys were fielded in Spring 2014.

Fifteen of the 16 potential respondents sent the more detailed survey responded (94%), and 8 of the 11 potential respondents sent the general survey responded (73%). Of the 8 respondents to the general survey, one program provided comments on impacts by email rather than filling out the survey; therefore, we have survey-specific responses to the general survey for 7 programs, and report the comments for the other program separately.

The number of programs included in the survey results varies for each guide, since some programs did not answer the questions for a guide if they had not used that guide. Note, however, that some programs did provide impact survey responses for guides that they did not report directly using in the broad evaluation interview. This could be because they mistakenly answered the questions (e.g., they may have been thinking about the impacts of patient status functionality in their IIS rather than impacts of using the Patient Status Guide) or because they had used in a guide in a way that did not come up in the broad evaluation interview or had occurred after the broad evaluation interview. We were able to clarify this issue only for those programs with whom we conducted in-depth interviews. For example, in one case, a program had implemented changes to their IIS related to the Incoming Data Quality Guide after the broad evaluation interview; we adjusted the count of direct users for that guide in the final analyses.

In-Depth Interviews

The 8 IIS programs initially identified as in-depth interview candidates were invited via email to participate in a second interview at the same time that they were sent a link to the detailed impact survey. One of these programs was one of the two programs from whom we received a returned email indicating a recent IIS manager transition. All of the remaining 7 programs agreed to participate. Interviews were scheduled for a 60-minute block of time and conducted in Spring 2014. In-depth participants were offered a gift basket to acknowledge their participation in the in-depth interview process. See the in-depth evaluation interview guide in Appendix C.

The in-depth interview was intended to fill any gaps from the broad evaluation interview, and obtain more detail on operational consistency with the guides and on impacts of using the guide, including getting clarification on impact survey responses, if needed. If information from the in-depth interviews differed from the broad evaluation interviews or impact surveys, the information from the in-depth interviews was used in the final analyses, and is reflected in this report.

3.0 STUDY FINDINGS

Table 2 illustrates summary characteristics for 44 respondents. The most common IIS vendor platform is WIR (32%), followed by STC (16%) and Envision (14%); in-house systems make up almost one-third of IIS (30%). The WIR platform, customizable by IIS programs, is also shown broken down into its four main “base” platforms, as designated by the respective states responsible for the version configuration. Also, note that the IIS vendor that provides ongoing support to an IIS program may differ from the vendor that supplied their IIS platform.

As shown in the table, these programs represent a diverse set of IIS in terms of ages of persons included in the registry, the consent models for children and adult inclusion, as well as the degree to which vaccine dose reporting to the IIS is mandated for certain types of providers.

Some IIS programs were involved in the development of the three guides being evaluated, such as being a working group member or a subject matter expert, and over a quarter of IIS programs have or had representation on the MIROW Steering Committee.

For over a third of respondents, the IIS manager in their jurisdiction had changed within the past 2 years (since the time of the interview) or during the project period. This turnover may be particularly significant as it can contribute to lapses in institutional history pertaining to the application of MIROW guides. Just over a quarter of IIS programs have had an IIS platform

Table 2: Respondent Characteristics (n=44)[1]

	%
IIS Vendor Platform	
Envision	14
STC	16
WIR (all)	32
WIR-WI	11
WIR-NY	11
WIR-OR	5
WIR-ME	5
Other IIS vendor	10
In-House system	30
Ages in IIS[2]	
All ages	95
Children	5
Consent[2,3]	
Child	
Implicit consent with opt out	70
Explicit consent (opt in)	7
No consent options provided	23
Adult	
Implicit consent with opt out	66
Explicit consent (opt in)	18
No consent options provided	11
N/A (no adult data in IIS)	5
Mandated Reporting to IIS[2,3]	
Private providers	55
Public providers	61
Pharmacies	55
Other (e.g., schools)	11
None	30
Involvement in MIROW	
Patient Status Guide (2005)	23
Vaccination-Level Deduplication Guide (2006)	25
Incoming Data Quality Guide (2008)	16
MIROW Steering Committee (current or past)	27
CDC Grant Participant	
Electronic health record (EHR) interoperability	75
Two-dimensional (2D) barcodes pilot participant	23
Sentinel site (current or past)	21
Recent IIS Transitions	
IIS manager turnover (≤2 years from date of interview)	39
IIS platform transition (roll out ≤2 years from date of interview)	27

Notes:

[1] Excludes one program whose IIS was in the procurement stage at time of interview.

[2] Information broadly grouped for display purposes; characteristics may apply only to a subset, rather than all, of a certain category (e.g., for certain vaccines, ages, providers).

[3] Original data from http://www2a.cdc.gov/vaccines/iis/iissurvey/legislation-survey.asp, with updated information obtained during broad evaluation interviews, if applicable.

transition (e.g., changing from one IIS vendor platform to another) within the past 2 years (since the time of the interview), including those that have completed rolling out their new system to providers within this time period.

3.1 Summary of MIROW Guide Use

Among the 45 IIS programs that participated in the broad evaluation interview, most reported familiarity with each of the three MIROW guides, most commonly for the Vaccination-Level Deduplication Guide (87%) followed closely by the Patient Status Guide (84%) and to a lesser degree the Incoming Data Quality Guide (78%).

Of the 45 IIS programs, 32 (71%) reported direct use of one or more of the three guides, with 13 programs reporting no direct use of any of the three guides or not knowing whether the guides had been directly used due to a recent IIS manager transition. The Patient Status Guide had the highest level of direct use (64%), followed by the Incoming Data Quality Guide (58%) and the Vaccination-Level Deduplication Guide (56%). Among the 32 direct users, 18 IIS programs directly used all 3 guides, 12 used 2 guides, and 2 used 1 guide.

Indirect use was attributed to 10 programs for the Patient Status Guide, 23 programs for the Vaccination-Level Deduplication Guide, and 20 programs for the Incoming Data Quality Guide. Looking at overall use (i.e., direct and indirect use combined) for the 45 programs, 73% used the Patient Status Guide (n=33), 82% used the Vaccination-Level Deduplication Guide (n=37), and 76% used the Incoming Data Quality Guide (n=34).

The remainder of the report summarizes for each guide: the types and timing of direct use, indirect and overall use, impacts of and barriers to direct use, and operational consistency and concerns with guide-related functionality and processes. Comments from IIS programs, paraphrased from comments gathered during the interviews or impact surveys, are used to highlight certain findings.

3.2 Patient Status Guide

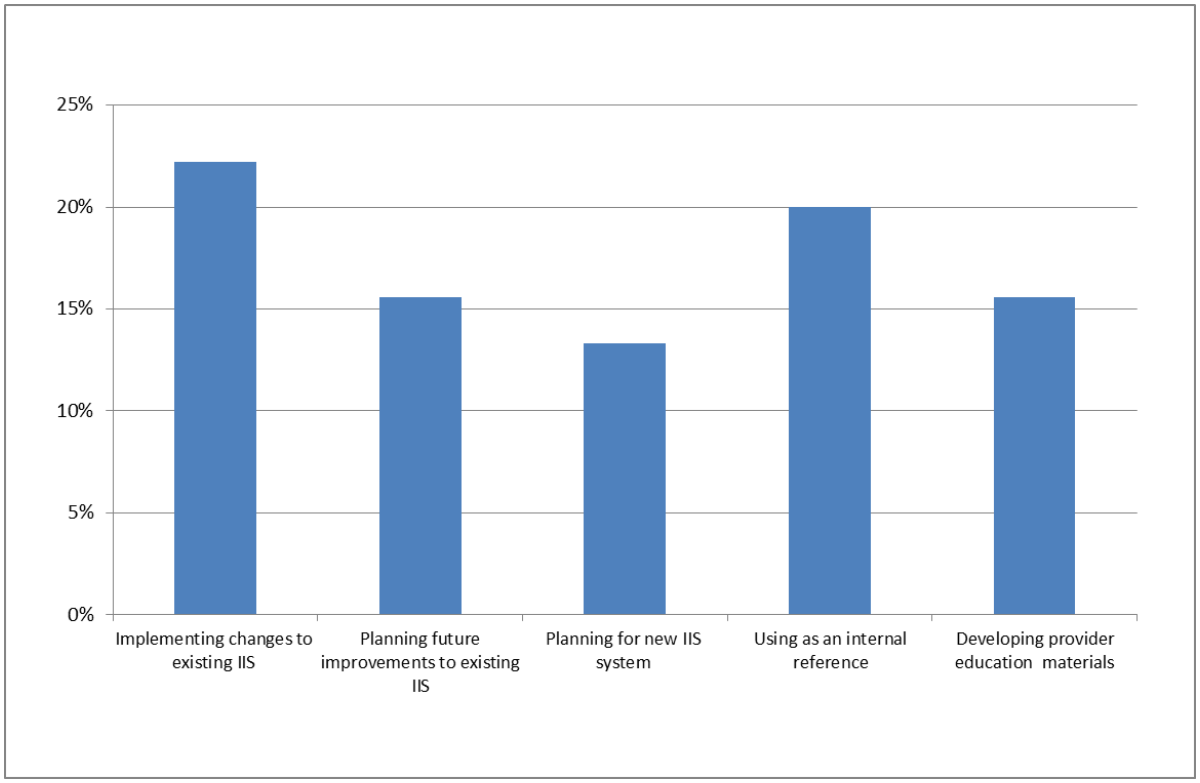
Among the 45 responding IIS programs, most (84%) reported at least some familiarity with the Patient Status Guide. Among those not familiar with this guide (n=7), 5 programs have experienced a recent IIS manager transition (i.e., within the past 2 years).

Direct Use of Patient Status Guide

The majority (64%) of responding IIS programs (n=29) reported directly using the Patient Status Guide. The types of direct use reported by these programs are summarized below and shown in Figure 1. A few programs (n=3) were unsure whether the guide had been used due to a recent IIS manager transition.

- **Implementing changes to existing IIS:** The Patient Status Guide has been used to identify and implement patient status-related IIS functionality and/or business practices by 10 IIS programs. Three of these programs specifically noted that the guide formed the basis of discussions with and/or requirements given to technical staff or their IIS vendor.
- **Planning future improvements to existing IIS:** Other IIS programs have used this guide to identify areas in their existing IIS for potential future changes related to patient status (n=4), or have plans to use the guide in this manner (n=3).
- **Planning for new IIS system:** Six programs reported using the guide in planning the patient status-related features of a new IIS system, such as being specifically referenced in RFP documents or informing the content of SOW language.

Figure 1: Direct Uses of Patient Status Guide (n=45)



- **Using as an internal reference:** A few programs (n=4) reported using the guide as an internal reference on best practices related to patient status or to validate existing business rules, but did not implement changes to their existing IIS. Two programs reported using the guide as a reference as they transitioned to a new IIS. One program reported referring their upper management to the guide to illustrate the degree to which their IIS aligned with national best practice standards. A few programs mentioned using the guides to help respond to the annual CDC IISAR survey (n=2) or to prepare for a CDC site visit (n=1); this type of use may be higher than reported, since programs were not specifically asked about this type of use.
- **Developing provider education materials:** Seven programs reported using the guide to develop or revise education materials for providers on patient status.

Timing of Direct Use of Patient Status Guide Use

Among direct users, some programs reported use of the guide prior to 2009, but use was more commonly reported during the last few years (i.e., since 2011). Use of the guide has often been prompted by the opportunity presented by transitioning to, or planning to transition to, a new IIS platform or product. Another impetus has been trying to address problems, such as those related to the denominator of patients used for reminder/recall efforts and coverage assessments, or improving processes linked to patient status, such as reminder/recall functionality. A few programs reported that they use the guide on an ongoing basis as a resource document. Several programs (n=13) indicated that they plan to use information from this guide in the future, while another 4 programs said that future use was possible. Two programs said they will wait to consider any changes to patient status until the new MIROW guide on patient status is released.

Note that there was a lag in publication date between the full and mini guides for the Patient Status Guide (2005 and 2009, respectively). Publication and dissemination of the mini guide may have affected the timing of guide use.

Indirect and Overall Use of Patient Status Guide
In addition to direct use of this guide by IIS programs, 10 IIS programs were classified as having indirect use of the Patient Status Guide. Seven of the 10 programs use an IIS vendor product for which the IIS vendor reported that this guide has specifically influenced how patient status is addressed in their product for all of their IIS clients. Two programs reported that their IIS had features consistent with the guide that pre-dates their review of the guide, and another procured a new system that had features consistent with the guide. Combining direct and indirect use, 33 of the 45 IIS programs (73%) reported some use of the Patient Status Guide.

Impacts of Direct Use of Patient Status Guide
Among the direct users of the guide that responded in interviews to whether the guide has been helpful (24 of 28 programs), all of the programs indicated that it has been. Examples of ways in which programs said it was helpful, in interviews or survey comments, include:

> "Although our IIS was already doing many things outlined in the guide before it was published, the guide has helped with refining our processes and knowing that we are going in the right direction."
>
> "The guide was very helpful for working with our state IT in developing the ability to capture patient status."
>
> "The guide provides a good starting point for considering the larger issue of denominator management."
>
> "The guide presents a recommended solution that would keep us in the mainstream in terms of how we are managing our data."
>
> "The guide provided the impetus for discussions between IIS and VFC program staff on patient status, and helped us to realize that inactivating patients impacts coverage rates."
>
> "Having best practice to reference when working with consortium members is very useful, especially when conflicting use cases are presented."

Positive Impacts
Among the direct users that responded to the section on the Patient Status Guide in the detailed impact survey (n=15), positive impacts far outweighed the negative impacts (Table 3). The positive impacts noted most commonly relate to patient status functionality (e.g., ability to capture provider-level patient status, patient status categories, and the protocol for changing patient status), but also included more downstream impacts, such as the ability to conduct assessments using the IIS.

Some other specific positive impacts reported by IIS programs, through the interviews or detailed impact survey comments, include:

- Increased accuracy in provider patient lists (n=2)
- An increase in the number of patients being inactivated (n=1), whereas another program that has addressed misuse of the patient status field has seen a decrease in patient status changes
- A decrease in the discrepancy between the population in the IIS and the state estimated population (n=1)
- Better targeting of data cleansing efforts (n=1)
- Increased accuracy of patient address information, by prompting at least some providers to actually enter changes of address rather than just inactivating patients (n=1)

Among the direct users that responded to the general survey on the impact of using the Patient Status Guide (n=7), all impacts noted were positive. All felt that the guide has positively

Table 3. Extent of Specific Impacts from Direct Use of Patient Status Guide, Detailed Impact Survey (n=15)

Extent to which use of Patient Status Guide impacted…	N[1]	Substantial Positive Impact	Some Positive Impact	No Impact	Some Negative Impact	Substantial Negative Impact	Don't Know	Not Applicable to our IIS
Ability to capture patient status at provider level in your IIS	15	5	7	1	0	0	0	2
Ability to capture patient status at jurisdictional level in your IIS	15	2	4	1	0	0	0	8
Categories used to define patient status in your IIS	15	4	7	2	1	0	0	1
Protocol for when appropriate to change patient status in your IIS	14	3	10	0	0	0	0	1
Amount of time spent developing protocol for capturing patient status in IIS	15	1	5	4	1	0	2	2
Amount of time spent implementing protocol for capturing patient status in IIS	15	1	8	1	2	0	1	3
Rules/logic used for which patient status categories to include for reminder/recall in your IIS	15	3	6	3	0	0	1	2
Rules/logic used for which patient status categories to include in coverage assessments in your IIS	15	4	3	5	0	0	1	2
Amount of time spent educating providers about use of patient status in IIS	15	0	7	5	1	0	0	2
Amount of time spent monitoring appropriate use of patient status in IIS	15	0	6	5	1	0	0	3
Amount of time spent addressing data quality problems related to patient status in your IIS	15	1	4	2	3	0	2	3
Timeliness with which providers reflect patient status changes in your IIS	15	1	4	4	0	0	3	3
Proportion of actual patient status changes that providers record in IIS (i.e., completeness)	15	1	6	2	0	0	3	3
Accuracy of patient status for provider sites in IIS	15	0	5	2	0	0	5	3
Accuracy of patient status for geographic jurisdictions in IIS	15	1	4	2	0	0	4	4
Degree to which your program uses IIS to conduct reminder/recall	15	3	3	6	0	1	0	2
Degree to which providers use reminder/recall functions in IIS	15	0	9	3	0	0	1	2
Ability to conduct coverage assessments using IIS	15	2	8	3	0	0	1	2
Degree to which your program uses assessment functions/reports in IIS	15	2	7	2	0	0	0	4
Degree to which providers use assessment functions/reports in IIS	14	2	6	1	0	0	1	4
Direct financial impact on your program	15	0	0	6	1	0	6	2

[1] Note that not all questions were answered by each respondent and therefore individual questions may have <15 respondents. Also, counts of responses to individual questions may sum to >15 because respondents could select all responses they felt applied.

impacted their understanding of both best practice guidelines related to patient status and how well their IIS reflects these best practices. In addition, all reported that the use of the guide positively impacted their ability to establish provider-level business processes related to patient status and to explain these processes and their rationale to providers. Among these survey respondents for whom it was applicable, all cited positive impacts of guide use on their ability to identify future changes to their IIS related to patient status (n=6) or to specify desired patient status functionality when transitioning to a new IIS (n=2).

Some general positive impacts were also noted separate from the general impact survey. One program has found that the guide positively impacted their ability to understand what is being discussed with their IIS vendor and how the business rules will be applied within their IIS. Another program indicated that the guide positively impacted their understanding of best practice guidelines related to patient status and their ability to identify future changes to their IIS related to patient status.

Negative Impacts

Although positive impacts were more commonly reported than negative impacts in the detailed impact survey, five programs did cite 10 negative impacts of using the guide in this survey (Table 3). In total, 5 negative impact ratings were reported by one program, whereas other programs reported fewer negative impacts (2 impacts, n=1; one impact, n=3). For both programs citing more than one negative impact, the impacts related to the amount of time spent by their program on patient status-related activities. The program citing 5 negative impacts found the entire process of establishing patient status in their IIS to be very time consuming, but also noted that:

> "The impact was negative initially, but that doesn't mean that the end result is not worth it."

Of the remaining negative impacts reported in the detailed impact survey, the negative financial impact relates to the cost of making software or application changes. Two of the negative impacts reported are more a function of patient status-related functionality in the IIS rather than use of the guide, based on clarification provided by these programs. The negative impact for the program's use of the IIS to conduct reminder/recall is due to the IIS having limited reminder/recall functionality, and the negative impact for patient status categories has to do with provider dissatisfaction with transitioning to a new IIS that has more limited category options than the prior product.

No Impact or Unknown Impact

Among respondents to the detailed impact survey for this guide (n=15), 12 programs indicated that the guide had either no direct financial impact on their program (n=6) or they were unsure of the financial impact (n=6). Several programs (n=6) also reported that use of the guide did not impact the degree to which the program uses the IIS to conduct reminder/recall. A few programs were unsure of the impact of guide use on the accuracy of patient status at either the provider- or geographic jurisdiction-level. Over half of respondents (n=8) indicated that "the ability to capture patient status at the jurisdiction level" as being "Not Applicable".

From the interviews, a few other areas of no or unknown impact were identified. A few programs (n=3) noted that they have not seen an impact of guide use on provider use of reminder/recall. One of these programs recently transitioned to a new IIS that has much improved reminder/recall functionality, which is a confounding factor. Two programs reported being unsure of the impact of guide use on coverage rates, while two others do not think coverage rates have been impacted. One program was unsure of the impact of guide use on reminder/recall use.

Barriers to Direct Use of Patient Status Guide

Based on responses to the broad and in-depth evaluation interviews from 45 programs, several programs noted reasons for not using, or for delaying use, of the guide, including implementation of specific concepts, such as a jurisdictional-level patient status. The most commonly reported barrier to direct use of the Patient Status Guide was that in recent years, other competing IIS program priorities (e.g., vaccine inventory, VFC eligibility status, meaningful use) have often overshadowed patient status-related issues (n=9). A few programs (n=4) noted that limited resources and staff were also a factor. Concerns about inappropriate use of a patient status field led to either delayed implementation of patient status (n=1) or delayed outreach to providers about use of an existing field (n=1). Programs with impending transitions to a new IIS (n=2) were focusing less on the capabilities of their existing systems and more on designing the desired functionality for their new systems. In addition, one program reported that their existing IIS is meeting their needs regarding patient status, and that the level of detail outlined in the guide did not seem necessary for their purposes.

Operational Consistency with Patient Status Guide

Based on responses to the broad and in-depth evaluation interviews from 44 programs, this section describes the degree to which IIS programs have functionality or processes in place that are consistent with specific elements of the Patient Status Guide.

Provider-Level Patient Status

The Patient Status Guide states that providers have the first level of responsibility for immunizing their patients and, therefore, that patient status should be tracked at the provider level. All 44 IIS programs reported tracking patient status at the provider level to some degree. The majority (n=30) of programs reported having instructions available for providers regarding use of the patient status field (no information was available for 11 programs), though some noted that this guidance is mainly directed to VFC providers via the immunization program. Among the programs who commented on the extent of provider use of this field (n=33), several programs were unsure (n=6) and one program noted that they do not have the resources to track use of the field. Numerous programs (n=19) indicated there was at least some use of the patient status field by providers, although two programs noted that this was mainly for public providers. A few others (n=3) felt provider use of the field was very limited or insufficient. Eight programs reported no use or negligible use of this field by providers. In one of these cases, the IIS program enters information into the patient status field on behalf of providers. For another IIS, the functionality does not exist for private providers via their user interface, and use of the patient status field by local health departments (LHDs) and providers who submit via HL7 data exchange is unknown.

Some notable variations were reported regarding how provider-level patient status is operationalized:

- **Presentation of patient status options**. In some IIS, once a provider choses “inactive” from a drop-down menu in the user interface, they are then presented with a list of reasons from which to choose for the patient’s inactive status; some require a date for when the inactive status is effective. One IIS noted that its patient status options are found under two separate fields, one that deals with a patient’s overall status with a provider and the other related to address/outreach information.
- **Patient status versus patient affiliation**. Many programs differentiate patient status and patient ownership (e.g., primary, secondary) or clinic affiliation.
- **Providers authorized to change patient status**. One program reported that a provider can change a patient to an inactive status only if they were the last provider visited.
- **Automated patient status changes**. Variations on when a patient is automatically activated for a provider include: once the provider gives that patient a shot, if the

provider changes anything on the patient record, or if the provider searches for that patient. One program noted that a patient is activated for a provider if a vaccine is given, except for certain vaccine types (e.g., Hepatitis B birth dose, influenza) or provider types (e.g., pharmacy, hospital).

- **Assignment of active patients to providers**. Some IIS allow a patient to be active with only one provider, while others allow a patient to be active with more than one provider at a time.
- **Limited degree of implementation**. One IIS has only a "Yes/No" flag for MOGE. Another program has only a minimal flag to record bad addresses, though they are in the process of procuring a new IIS platform.
- **One-time vaccinators**. Some programs have incorporated one-time vaccination as a patient status category. In others, patients are activated for one-time vaccinators when a vaccination is given, and these vaccinators must go in and change the status to inactive or indicate that they do not want ownership of the patient.

Geographic Jurisdictional-Level Patient Status

The Patient Status Guide discusses the concept of public health agencies being responsible for ensuring the population within their geographic jurisdiction (i.e., city, county, or state) is immunized and, therefore, that patient status should also be tracked at the geographic jurisdiction level. Respondents reported wide variation pertaining to the implementation and use of geographic jurisdictional-level patient status. Many programs (n=20) reported the ability to run reports at the state and county level summarizing patient status. However, few programs (n=4) reported having a field for recording patient status at the geographic jurisdiction level, distinct from provider-level tracking, and only one of these IIS tracks both state- and county-level status. In one IIS vendor platform, the immunization program can be considered a provider and consequently can be assigned a provider-level patient status. For these IIS, patient status can therefore be tracked at the state level, though only one program using this platform reported using the field in this way.

Some IIS programs discussed processes in use for inactivating patients at the state level. One program that does centralized reminder/recall enters information from returned mail in their IIS. A few programs (n=4) have been able to also use adjunct data sources, such as National Change of Address (NCOA) files from the US Postal Service, to help with statewide inactivation efforts. Other programs (n=2) reported using automated rules, based on criteria such as patient age and length of time since information for that patient has been documented in the IIS, to help inactivate patients at the state level.

Implementation of Patient Status Categories

As illustrated in Table 4, the Patient Status Guide defines 6 patient status categories for provider-level patient status: Active, Inactive-MOGE, Inactive-lost to follow-up, Inactive-permanently, Inactive- unspecified, and Unknown. In addition, 5 categories are defined for geographic jurisdictional- level patient status; these are essentially the same as provider-level status, except for the "Inactive-unspecified" category. All programs have some way of identifying active patients at the provider level; two programs that have some issues with this functionality are planning to upgrade their IIS in the near future. (Note that for the remaining categories, there are varying degrees of completeness of the information across IIS programs.)

Among programs for which this information is available (n=34), all have an "Inactive-permanently" category, though many use the term "deceased" in the category name. One program noted that physicians did not understand the category label and preferred that it be called "Deceased". Use of the other patient status categories varies widely across IIS programs.

Table 4: Patient Status Categories from Patient Status Guide

Status	Provider Level	Geographic Jurisdiction Level
Active	An individual has: a. received an immunization from a provider, b. has been identified as a patient of a provider by a health plan, c. has been identified as a patient by a provider, or d. has been identified as a patient of a provider based on other medical information	Documentation exists that the individual resides within the geographic jurisdiction.
Inactive-MOGE	There is documentation that a patient has: a. moved out of immediate area, b. gone to another practice, or c. moved with no forwarding address.	Documentation exists that the individual no longer resides in the geographic jurisdiction.
Inactive-lost to follow-up	Attempts to contact an individual have been documented but there is no documented response received, or there is inadequate contact information for the individual.	
Inactive-permanently	The patient is deceased	
Inactive-unspecified	A provider has determined that a patient is no longer active for immunization purposes but did not specify a reason.	N/A
Unknown	A patient has been made known to a registry via an electronic interface without status being specified.	An individual at least 7 years of age with no documented immunizations after their birth dose, OR An individual for whom no contact or event (e.g., vaccination, change to the record) has been documented in their record for 10 years.

Source: http://www.immregistries.org/resources/MIROW-MOGE_Chapter_Final_122005_rev1.doc

One IIS vendor platform has 7 categories that can be mapped to either the "Inactive-MOGE" or "Inactive-lost to follow-up" categories; there is not an "Inactive-unspecified" or "Unknown" category, but rather an "Other" category (with no direct way to specify the precise reason). Another IIS vendor platform has an overall inactive status and moved out-of-state status; two users of this platform also mentioned having an additional category to indicate a one-time vaccinator. Two other programs reported having a one-time vaccinator category. The least adopted categories reported by IIS programs are "Inactive-unspecified" and "Unknown."

Two programs reported that their patient status options incorporate patient consent (whether opt-in or opt-out). Address information, which relates to MOGE and lost to follow up status, is sometimes recorded separately, such as with check boxes for invalid/undeliverable addresses or for an out-of-state address, and is not necessarily linked to the patient status field.

Reminder/Recall and Coverage Assessments

The Patient Status Guide outlines rules for including or excluding patients from reminder/recall and immunization coverage assessment activities based on their provider-level and geographic jurisdiction-level patient status. Among 44 IIS programs, most (82%, n=36) reported that private or public providers have the ability to do reminder/recall (3 reported that they do not, and information was not available for the remainder). Among those 36 programs, most felt that providers actually use the reminder/recall functionality, though two programs did not know, and one did not think so. Among those that commented on the extent of reminder/recall use by

providers, two programs noted that they were unable to gauge the extent of use, another two programs said it was used by only a small number of providers, and a few were confident that public providers use it but were either unsure whether private providers do or noted that there was no reminder/recall functionality available to private providers.

Among 44 IIS programs, 71% (n=31) reported having set rules/logic for inclusion of patient categories in reminder/recalls and coverage assessments (information was not available for the remainder).

Extent to which Consistency with Guide is Known

IIS programs that were not direct users of this guide (n=16) typically did not know the extent to which their IIS is consistent with the Patient Status Guide, though two of these programs reported having a general idea about consistency of their IIS with the guide. One of these programs has identified changes related to patient status that they would like to make in the future. One program noted that they rely on their IIS vendor to ensure consistency with the guides, which the IIS vendor confirmed that it does.

Among direct users, two programs have done a detailed comparison of their IIS to the guide, while two others report that they look at consistency with the guide when they complete the IISAR. Several programs (n=9) reported having a general idea of how consistent their IIS is with the guide. One program was told by their IIS vendor that it is consistent with the guide, and another relies on its IIS vendor for assuring consistency with the guide (verified by the IIS vendor). Eight programs said they do not know the extent to which their IIS is consistent with the guide. However, two of these programs are transitioning in the near future to a new IIS system and expect the new system to be consistent with the guide based on the specifications they have put in place. Information on this topic was not available for the remaining 4 IIS programs.

Issues/Concerns with Patient Status

Based on responses to the broad and in-depth evaluation interviews from 45 programs, IIS programs raised various issues related to tracking provider-level and jurisdiction-level patient status.

Provider-Level Patient Status

Respondents reported low utilization of the provider-level patient status field by providers. A few noted that the issue extends to getting providers to report immunizations at all through the web-based user interface (n=2) or for non-VFC providers (n=1). Some IIS programs specifically noted that it is difficult for providers to know what actually happened to patients (n=2) or when it is appropriate to inactivate (n=2). Another said that it would be helpful to have more details on the nature of the three patient contacts they should seek before inactivating.

Several comments pertain to the labor or time impacts of maintaining patient status. A few programs (n=3) commented that inactivating patients can be a very labor intensive for providers, especially in instances where there are likely large numbers that should be inactivated, such as for adolescent patients or legacy data that has been entered into the IIS. Two programs reported having some automated inactivation rules in place that are consistent with or similar to the guide's recommendations specified for the "Unknown" category of geographic-level patient status, but have applied them at the provider level. Another program noted that their IIS offers providers a way to do mass inactivation.

Inappropriate use of the field (i.e., inactivating patients to improve immunization rates) has rarely been found to be an issue, though two programs noted this issue specific to LHDs. One IIS program that transitioned from an IIS system with detailed inactive subcategories to one with simpler options (inactive or deceased) has been getting pushback from providers, who prefer the more detailed categories.

Geographic Jurisdiction-Level Patient Status

As noted above, few IIS programs are using a standalone field to record patient status at the jurisdictional level. One IIS program felt that it needs more details on jurisdictional status in order to consider implementation. Another felt that LHDs will not use the field, so they do not want to put in the time and resources to add the functionality. Similarly, another IIS noted that since they do not have the resources to implement the business practice (county-level responsibility, then state), it did not make sense to implement the functionality.

A few IIS programs noted conceptual issues related to a geographic-level patient status, i.e., getting pushback from LHDs regarding patient ownership. One noted that LHDs do not want to inactivate people unless they are absolutely certain, while two others noted that LHDs do not want to be held accountable for patients that are not theirs, even if those patients are not active for any private providers in their jurisdiction.

One-Time Vaccinators

The manner in which one-time vaccinators (e.g., for influenza vaccine) are addressed for patient status varies across IIS programs. The way that programs deal with one-time vaccinators is linked to their rules for automatic patient activation and whether their system allows one-to-one or one-to-many patient ownership. One IIS program highlighted a problem in their system such that if a one-time vaccinator inactivates a patient, then the system will auto-assign that patient to the last provider visited – even when that provider has previously and appropriately inactivated that patient. This has been frustrating for those providers that have been trying to clean up their patient lists.

Electronic Data Interchange

Some IIS programs (n=6) reported that they are not able to get patient status information from at least some electronic reporters. One program noted that this can be either because the field is not there or that an existing field is not populated; two other programs said that the same type of patient status information is not captured via electronic exchange. A few other programs noted that through electronic exchange, a patient's status can be changed from inactive to active based on receiving vaccination information for an existing patient, but that it cannot provide the different subcategories of inactive status, as outlined in the guide. A few IIS (n=4) noted that as providers turn to electronic reporting, the less time they spend utilizing the functions of the IIS via the user interface (e.g., reminder/recall) and editing individual patient records, including setting patient status.

The patient status categories defined in IIS programs' HL7 guides appear to be based on the suggested values in the CDC/AIRA HL7 guide,[4] which match up to the category names in the Patient Status Guide, but are not defined. These categories do not necessarily match up with the patient status categories that IIS programs are using in their user interface.

Other Issues

- One IIS program said that their IIS MOGE guidelines must be aligned with their Medicaid program's MOGE rules.
- One program reported that they do not directly use the IIS to assess statewide coverage rates; they pull an extract from the IIS to which they then apply additional filters.
- One IIS program said that patient status in their jurisdiction is complicated by major issues with transient populations.
- One program said that they do not have enough resources to reflect information from returned postcards from centralized reminder/recall postcards in their IIS.

[4] Centers for Disease Control and Prevention. IIS Health Level 7 (HL7) Implementation. http://www.cdc.gov/vaccines/programs/iis/technical-guidance/hl7.html

- One program noted that it is not just a matter of adding the functionality in terms of the various inactive patient status categories, but that the program also needs to have processes in place to try to find MOGE and lost-to-follow up patients, and the resources to educate providers about the changes.
- One program would like more detail on who can document deceased patients in the IIS.
- One program posed the question of whether "moved" should be separate from "gone elsewhere".

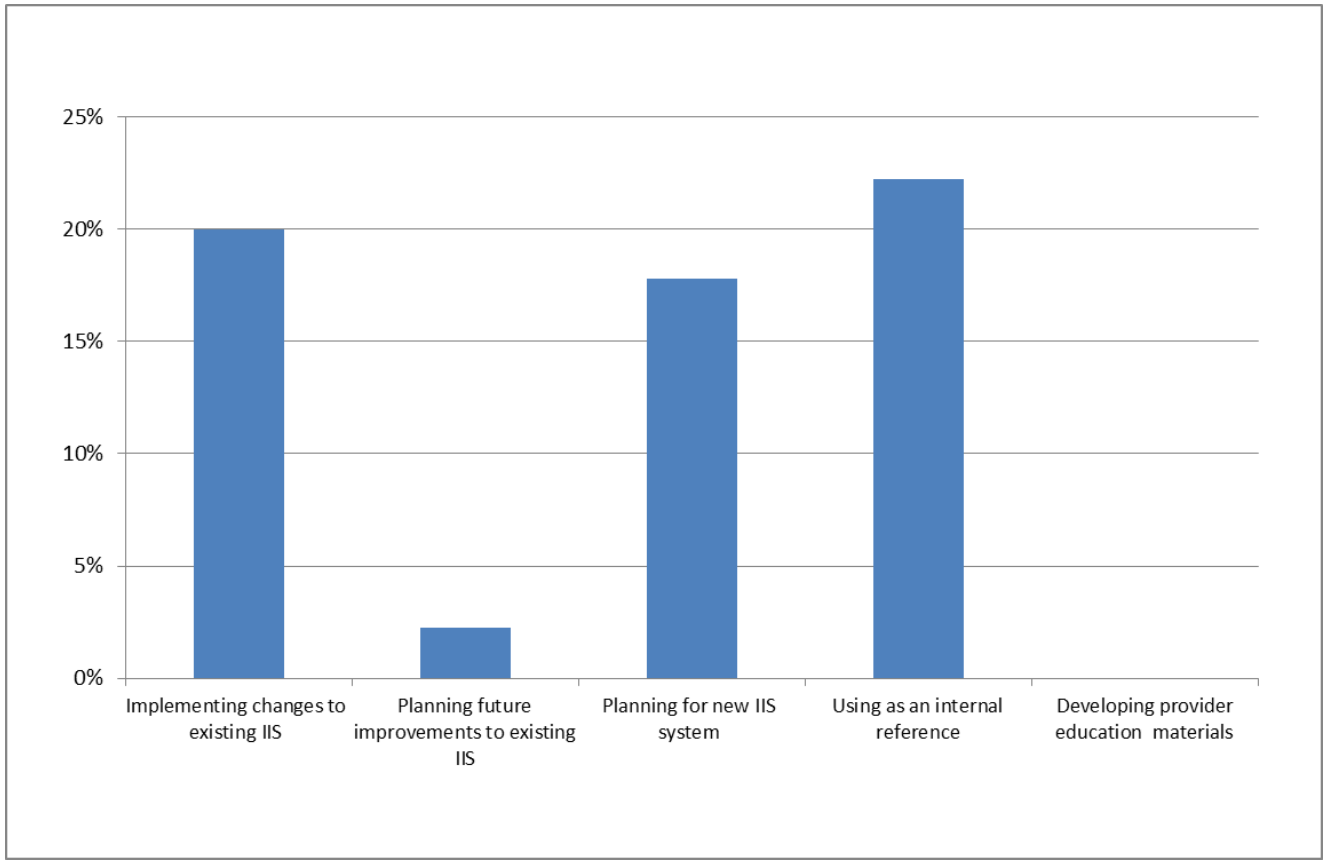
3.3 Vaccination-Level Deduplication Guide

Among the 45 responding IIS programs, most (87%) reported at least some familiarity with the MIROW Vaccination-Level Deduplication Guide. Among those not familiar with this guide (n=6), four programs have experienced a recent IIS manager transition.

Direct Use of Vaccination-Level Deduplication Guide

Over half (56%) of responding IIS programs (n=25) reported directly using the MIROW guide on vaccination-level deduplication; types of direct use reported by these programs are summarized below and in Figure 2. A few programs (n=5) were unsure whether the guide had been used, four of which have experienced a recent IIS manager transition.

Figure 2: Direct Uses of Vaccination-Level Deduplication Guide (n=45)



- **Implementing changes to existing IIS:** Nine programs have used this guide to develop or refine their existing vaccination-level deduplication algorithm. One of these programs specifically noted that the guide was provided to their IIS vendor to incorporate into their system.
- **Planning future improvements to existing IIS:** One IIS program reported using this guide to identify areas in their existing IIS for potential future changes related to vaccination-level deduplication.

- **Planning for new IIS system:** Eight programs reported using the guide in planning the vaccination-level deduplication features of a new IIS system, which includes referencing the guides in RFP documents, informing the content of SOW language, or developing the vaccination-level deduplication algorithm for the new system.
- **Using as an internal reference:** Three programs reported using the guide to inform manual deduplication decisions. A few programs (n=4) reported using the guide more generally as an internal reference on best practices related to vaccination-level deduplication. Two other programs reported using the guide as a reference as they transitioned to a new IIS. One program mentioned using the guides to help prepare for a CDC site visit.
- **Developing provider education materials:** No programs mentioned using this guide for preparation of provider education materials.

Timing of Direct Use of Vaccination-Level Deduplication Guide Use

Among direct users, use of the guide was most commonly reported (n=13) during the last few years (i.e., since 2011). Some programs reported using the guide right around its publication date (n=5) (i.e., 2006-2007), with a few others (n=4) around the years 2008-2010. A few programs (n=3) said that they use the guide on an ongoing or as needed basis as a resource document. Information on timing of guide use was not available for two programs. Use of the guide has often been prompted by the opportunity presented by transitioning to, or planning to transition to, a new IIS platform or product. Another impetus for guide use has been the introduction or expansion of electronic data exchange, which generates more duplicate vaccinations.

Some programs (n=4) indicated that they plan to use information from this guide in the future. One of these programs specifically noted that they plan to expand the interval (i.e., number of days) within which potential duplicates are identified. Three other programs said that they may use this guide in the future. One of these programs would like to look into expanding the selection interval as well increasing the automation of deduplication decisions.

Note that there was a lag in publication date between the full and mini guides for the Vaccination-Level Deduplication Guide (2006 and 2009, respectively). Publication and dissemination of the mini guide may have affected the timing of guide use.

Indirect and Overall Use of Vaccination-Level Deduplication Guide

In addition to direct use of this guide by IIS programs, 23 IIS programs (51% of respondents) were classified as having indirect use of the Vaccination-Level Deduplication Guide. Fourteen of these 23 programs use the same IIS vendor platform system. Vaccination-level deduplication functionality in this platform pre-dates the guide and influenced development of the concepts ultimately adopted in the guide. An additional 7 programs use an IIS vendor product for which the vendor reports that this guide has specifically influenced how vaccination-level deduplication is addressed in their product, and these capabilities are available to all of their IIS clients. The remaining two programs reported that their IIS had features consistent with the guide that pre-dates the guide. Combining direct and indirect use, 37 of the 45 IIS programs (82%) reported some use of the Vaccination-Level Deduplication Guide.

Impacts of Direct Use of Vaccination-Level Deduplication Guide

Among the direct users of the guide (n=25), 16 IIS programs responded to whether the guide has been helpful and of those, 15 indicated that it has been helpful for developing or improving their vaccination-level deduplication algorithm. The remaining program recently transitioned to a new IIS and is focusing on patient-level deduplication first, but expects this guide to be helpful in the future. Program comments related to the helpfulness of this guide, from the interviews or impact surveys, include:

"It was very helpful to have the guide when we recently revisited our deduplication algorithm to make changes to the weighting algorithm."

"The guide was very helpful for putting this algorithm in place."

"Although we have not been able to implement certain things due to the nature of our homegrown system, the guide was extremely helpful in trying for the best practices, and teaching us how to think about data quality."

"At the time of guide development, we had started developing our own vaccine deduplication algorithm, and the guide helped us enhance it."

Positive Impacts

Among the direct users that received and responded to the section on vaccination-level deduplication in the detailed impact survey (n=13), positive impacts far outweighed the negative impacts (Table 5). The most commonly rated positive impacts of using the guide were for the accuracy of vaccination doses reported to the IIS, followed by the protocol for addressing vaccine duplicates in the IIS.

One of these programs provided more details on how the guide saved staff time. First, the guide saved their staff time because they did not have to "reinvent the wheel" when developing the algorithm. Also, a major burden on staff time occurs when providers call the program to remove vaccine duplicates that they find; implementing the vaccination-level deduplication algorithm reduced these calls dramatically. Related to this, reducing the amount of vaccine duplicates that providers find helps to build trust with users.

One program reported a positive financial impact because they have been able to justify the creation of a data quality coordinator position in their grant to maintain their current level and focus on data quality, which is due in part to implementation of this guide.

Among the direct users that responded to the general survey on the impact of using the Vaccination-Level Deduplication Guide (n=7), all felt that the guide has positively impacted their understanding of how well their IIS reflects best practice guidelines related to vaccination-level deduplication and their ability to identify future changes to their IIS related to deduplicating vaccines. Most of these programs (n=6) reported a positive impact on their understanding of best practices related to vaccination-level deduplication. Among these survey respondents for whom it was applicable, all cited positive impacts of guide use on their ability to specify desired vaccination-level deduplication functionality when transitioning to a new IIS (n=3).

Other general positive impacts were noted by two programs separate from the impact surveys. One program has found that the guide positively impacted their ability to understand what is being discussed with their IIS vendor and how the business rules will be applied within their IIS, and another noted that it positively impacted their understanding of vaccination-level deduplication.

Negative Impacts

One program was responsible for all of the negative impacts of using the guide reported in the detailed impact survey (Table 5). Based on follow-up communication with this program, these negative impacts reflect the limitations of their current IIS with respect to vaccination-level deduplication rather than being an impact of MIROW guide use.

Table 5. Extent of Specific Impacts from Direct Use of Vaccination-Level Deduplication Guide, Detailed Impact Survey (n=13)

Extent to which use of Vaccination-Level Deduplication Guide impacted…	N[1]	Substantial Positive Impact	Some Positive Impact	No Impact	Some Negative Impact	Substantial Negative Impact	Don't Know	Not Applicable to IIS
The protocol for addressing duplicate vaccinations in your IIS	13	5	7	1	0	0	0	1
The amount of time spent by your program developing the protocol for addressing duplicate vaccinations in your IIS	13	5	6	1	0	1	0	0
The amount of time spent by your program implementing the protocol for addressing duplicate vaccinations in your IIS	13	3	7	1	1	0	0	1
The efficiency of identifying duplicate vaccinations in your IIS	13	5	6	1	0	0	0	1
The number of duplicate vaccinations reconciled in your IIS	13	7	4	2	0	1	0	0
The amount of time spent by your program to reconcile duplicate vaccinations in your IIS	13	5	6	2	0	1	0	0
The timeliness of vaccination doses reported to your IIS	13	1	4	7	0	0	1	0
The completeness of vaccination doses reported to your IIS	13	0	6	5	0	1	1	0
The accuracy of vaccination doses reported to your IIS	13	2	11	0	0	1	0	0
The degree of provider confidence in vaccine forecasting (i.e., which vaccines are due/overdue)	13	2	8	0	0	0	2	1
The degree to which your program uses the IIS to conduct reminder/recall	13	0	7	3	0	0	1	2
The degree to which providers use reminder/recall functions in your IIS	13	0	6	4	0	0	2	1
The ability to conduct coverage assessments using your IIS	13	1	8	2	0	0	0	2
The accuracy of coverage assessments conducted using your IIS	13	1	8	2	0	0	0	2
The degree to which your program uses assessment functions/reports in your IIS	13	2	7	2	0	0	0	2
The degree to which providers use assessment functions/reports in your IIS	13	1	7	1	0	0	2	2
The degree to which providers use your IIS to produce immunization records for patients	12	3	6	0	0	0	2	1
A direct financial impact on your program	13	0	1	7	0	0	4	1

[1] Note that not all questions were answered by each respondent and therefore individual questions may have <13 respondents. Also, counts of responses to individual questions may sum to >13 because respondents could select all responses they felt applied.

No Impact or Unknown Impact

Among detailed survey respondents for this guide (n=13), just over half of the programs gave a rating of "No Impact" of guide use to the timeliness of vaccination doses reported to the IIS (Table 5).

Nearly all of the respondents to the detailed survey indicated that the guide had either no direct financial impact on their program (n=7), or they did not know if it had a financial impact (n=4). One of the programs that said there was no financial impact of using the guide said that although they did save money because their IIS vendor did not have to develop the deduplication logic, they would not have otherwise gone to the extent outlined in the guide.

In its response to the general impact survey, one program noted that guide use had no impact on their understanding of best practices related to vaccination-level deduplication because their processes have been in place for a long time, and are "hard coded" by their IIS vendor.

From the interviews, a few other areas of no or unknown impact were identified. One program noted that they would not be able to quantify how many vaccines have been deduplicated because of using the guide, or how much time was saved. Another program said that although the guide was really useful, it has not had a huge impact on the queue for manual review, because they are still early in the ramp-up of data exchange. Another program was unsure as to how use of the guide affects vaccine forecasting; they surmised that because they use a pretty small window, the impact is probably small. In addition, because their method of producing immunization records for parents strips away extra (invalid) doses, there is no real impact there.

Barriers to Direct Use of Vaccination Deduplication Guide

Based on responses to the broad and in-depth evaluation interviews from 45 programs, some programs noted reasons for not using, or for delaying use, of the guide. Three programs reported needing to deal with patient-level deduplication issues before they can focus more on vaccination-level deduplication. They noted that addressing duplicate patients will hopefully take care of many of the duplicate vaccinations. Two programs (n=2) noted that limited resources and staff were a factor.

A program with a recent IIS manager transition noted that they have had to focus their initial efforts on other priorities. A program with an impending transition to a new IIS is focusing less on the capabilities of their existing systems and more on designing the desired functionality for their new system (which does include consideration of the guide).

Operational Consistency with Vaccination-Level Deduplication Guide

Based on responses to the broad and in-depth evaluation interviews from 44 programs, this section provides an overview of the processes that IIS programs have in place to conduct vaccination-level deduplication. All 44 programs reported having some degree of automated vaccination-level deduplication, ranging from just the identification of potential duplicates (i.e., all go to manual review) to those that have automated at least some of the deduplication decisions.

There are multiple ways in which duplicate vaccines are addressed, and the process may differ depending on the mode of data submittal. For the user interface, duplicates are generally identified as they are entered. Several IIS programs described how this is built into the edit checks for data entry, such that the person entering the vaccine would see a pop-up message indicating that the vaccine is a duplicate and asking for confirmation that the user still wants to enter the information. If they choose to enter the vaccine, it will typically be marked as an invalid dose. For electronic data, options for running deduplication algorithms include an automatic process that checks data as it comes in, regularly scheduled (e.g., nightly) checks, or on-demand reports.

There is typically a component of vaccination-level deduplication that is a function of patient-level deduplication, i.e., once a duplicate patient is identified, there may be some vaccination-level deduplication that needs to occur as the patient record is merged. This layer of vaccination-level deduplication is often done manually. Another common component of vaccination-level deduplication occurs as an automated algorithm that is executed when new vaccine records are received electronically; this process often does not have a manual review component.

Regarding manual vaccination-level deduplication, 31 programs reported having some degree of manual review (no information for 4 programs). Among these 31 programs, 18 programs said they are aware of the size of the manual review queue, while 2 programs that said that their IIS is too new to have a good sense of this yet (no information was available for 11 programs).

The guide recommends a maximum 23-day window for identifying potential duplicates, but notes that a smaller window can be used based on analysis of IIS-specific data. The maximum time window, in number of days, used for identifying potential duplicate vaccine events varies widely across programs, ranging from the same day (2 programs) to 23 days (4 programs). Of the 29 programs for which information was available, 76% used a window less than 10 days. One program noted that their interval is 3 days in the automated algorithm put in place by their IIS vendor, and 14 days for the additional post-load queries developed and used by the program. As noted earlier, a few programs are thinking about revisiting this timeframe.

When two vaccine records are determined to be duplicates, the guide recommends that two views be maintained in the IIS: (1) the "best" record of the two, and (2) a consolidated record that merges all available information into one record. Of the 61% (n=27) of programs that noted how matches are addressed, programs most frequently (n=11) reported that records are merged; 8 programs indicated that they keep the best record, 4 programs indicated that they keep both a "best" and consolidated record, and 3 programs said they keep the first record submitted to the registry. Many programs noted that whether the vaccine record source type is administered versus historical is taken into account in deduplication decisions.

The guide recommends that IIS keep an audit trail of vaccination-level deduplication decisions so that these decisions could be analyzed and, if needed, reversed. Out of 19 programs (no information for 25 programs), 16 programs indicated that there is some record kept of vaccination-level deduplication decisions, such that these deduplication decisions could be reviewed and, if needed, reversed.

A few other aspects of vaccination-level deduplication noted by IIS programs:

- One program noted that their system can catch only exact duplicates (given within a 5-day window).
- One program assigns a unique identifier to each vaccine dose. Data are extracted to run vaccination-level deduplication outside of the IIS; doses are renumbered as needed and re-entered into system.

Extent to which Consistency with Guide is Known

IIS programs that were not direct users of this guide (n=20) typically did not know the extent to which their IIS is consistent with the Vaccination-Level Deduplication Guide, though three of these programs reported having a general idea about consistency of their IIS with the guide. Two programs noted that they rely on their IIS vendor to ensure consistency with this guide (verified by the IIS vendor), and another assumes that it is consistent based on the involvement of their IIS vendor (confirmed by the IIS vendor) and former IIS manager.

Among direct users, several programs (n=11) reported having a general idea of how consistent their IIS is with the guide. One program notes that they have looked at consistency with the guide when completing the IISAR. Nine programs said they do not know the extent to which their IIS is consistent with the guide, one of which relies on its IIS vendor to ensure consistency with this guide (verified by the IIS vendor). Information on this topic was not available for two programs.

Issues/Concerns with Vaccination Deduplication

Based on responses to the broad and in-depth evaluation interviews from 45 programs, IIS programs raised a few issues related to deduplicating vaccines in their IIS.

Electronic Data Exchange

Some programs (n=4) said that the number of vaccine duplicates has increased greatly as the receipt of vaccine records via electronic exchange has increased. Two programs noted that vaccine duplicates are a particular problem from Medicaid and 3 others noted that certain electronic health records (EHRs) send the complete history every time a vaccine is administered. One of these programs noted that it is important to loop back with providers once the data are corrected in the system, so that they can make corrections on their end, rather than continuing to resend incorrect data.

Another program noted an issue with claims data. If a provider does not file a claim with the correct information, the data that the IIS receives (electronically) from Medicaid or health plans does not match and, therefore does not get caught via the deduplication algorithm. The program noted that they have been accepting claims data because provider reporting to the IIS is not required, and so getting information from claims helps fills the gap. But with meaningful use increasing the number of providers submitting electronically, the program wonders whether the cost-benefit of accepting claims may not be worth it.

Depending on the sophistication of the automated deduplication algorithm, an increase in vaccine duplicates being sent to IIS via electronic exchange can take up significant system processing time to identify and manage the duplicates, reduce data quality due to the addition of duplicates that are not getting caught, and increase the size of the queue for manual review.

One program said that they see quite a bit of bogus vaccine dates coming in from EHRs, as well as vaccines recorded as single antigens even when given as combination vaccines.

Another program noted that the guide does not adequately address how to deal with update messages sent to the IIS via HL7. IIS need to be able to distinguish between appropriate updates to an existing vaccine record from those messages that represent duplicates; update messages should not be treated as duplicates.

Hepatitis B Vaccine Birth Dose

Though largely a patient-level duplication issue, a few programs noted issues with vaccination-level deduplication related to the Hepatitis B vaccine birth dose. Two programs noted that when generic patient names are entered into the IIS (e.g., Baby Smith), providers have problems finding the patient in the IIS at the first well-baby visit, so the provider enters duplicate patient and vaccine information that is difficult to catch. Two other programs noted their standard vaccination-level deduplication algorithm had to be adjusted for the Hepatitis B vaccine birth dose because the record that would normally be deleted actually contains more detailed information for some fields that the programs want to maintain.

Other Issues

- One program found that the process currently in place to deduplicate vaccines is not well documented for their IIS.
- One program reported that their queue of vaccine duplicates to go through manually is very large.
- One program is having an issue with WIC clinics entering vaccines into the IIS as single antigens, even though the vaccines are already in the IIS as combination vaccines.
- Two programs noted that with the vaccination-level deduplication algorithm it is particularly important to think through the logic for decrementing doses from inventory via electronic exchange.
- For one program, records coming in via electronic exchange with different vaccines in same family are not marked as potential duplicates.

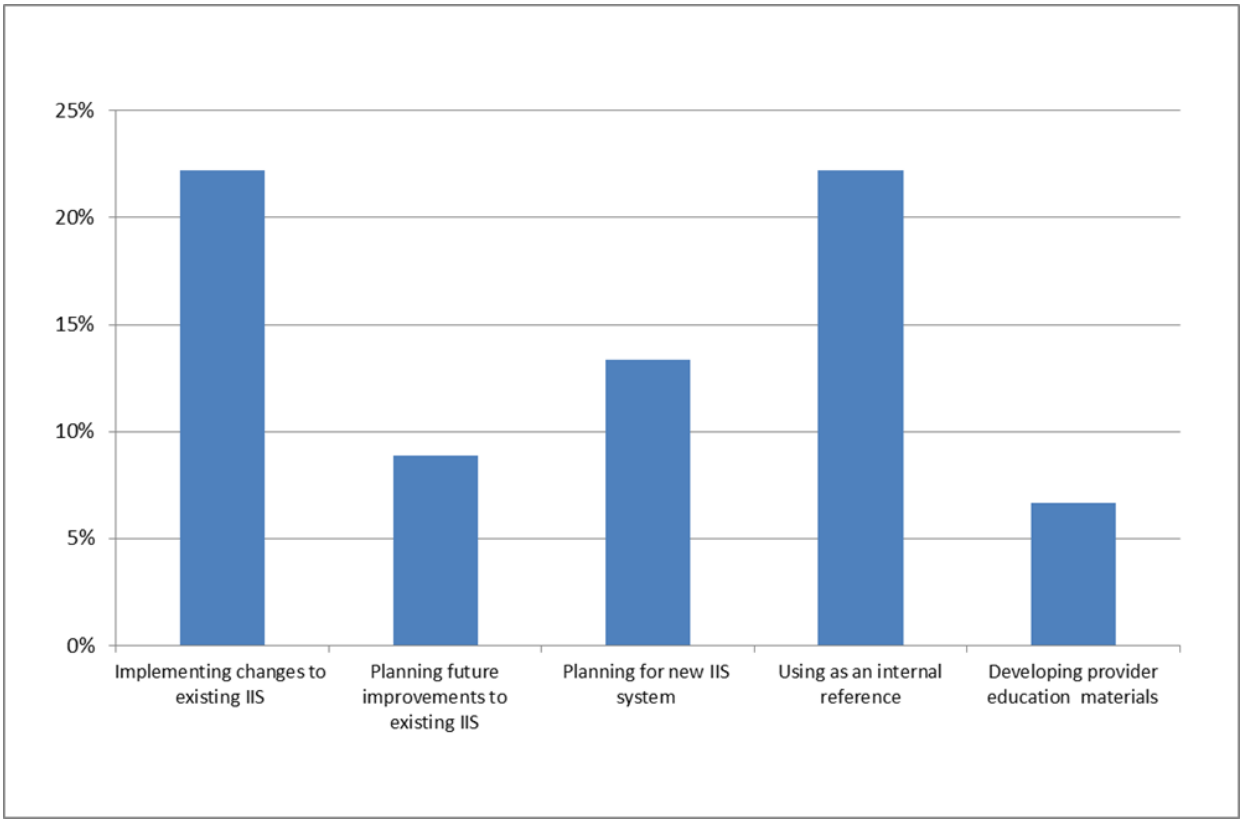
3.4 Incoming Data Quality Guide

Among the 45 responding IIS programs, most (78%) reported at least some familiarity with the first MIROW Incoming Data Quality Guide. Among those not familiar with this guide (n=10), five programs had experienced a recent IIS manager transition.

Direct Use of Incoming Data Quality Guide

About half (58%) of responding IIS programs (n=26) reported directly using the 2008 MIROW guide on incoming data quality. A few programs (n=4) were unsure whether the guide had been used, all of which have recently experienced an IIS manager transition. As summarized below and in Figure 3, several types of direct use were reported by IIS programs pertaining to the first Incoming Data Quality Guide.

Figure 3: Direct Uses of Incoming Data Quality Guide (n=45)



- **Implementing changes to existing IIS:** Ten programs have used this guide to identify and implement changes to their existing IIS related to incoming data quality, such as their protocol for pre-certification of providers or their pre-load data validation rules.
- **Planning future improvements to existing IIS:** A few IIS programs reported using this guide to identify areas in their existing IIS for potential future changes related to incoming data quality (n=3), or have plans to use the guide in this manner (n=1).
- **Planning for new IIS system:** Six programs reported using the guide in planning for the incoming data quality features of a new IIS system, which includes referencing the guides in RFP documents, informing the content of SOW language, or developing incoming data rules for the new system.
- **Using as an internal reference:** Seven programs reported using the guide as an internal reference on best practices related to incoming data quality. Two other programs reported using the guide as a reference as they transitioned to a new IIS. One program mentioned using the guides to help prepare for a CDC site visit.
- **Developing provider education materials:** Three programs mentioned using this guide for preparation of provider education materials related to pre-certification and/or rules to follow for incoming data.

Timing of Direct Use of Incoming Data Quality Guide Use

Among direct users, use of the guide was most commonly (n=12) reported to have occurred since 2011 while four programs reported using the guide prior to 2011. Six programs reported that they use the guide on an ongoing basis as a resource document. Information on timing of guide use was not available for three programs.

Some programs (n=5) indicated that they plan to use information from this guide in the future. Two other programs said that they may use this guide in the future. A new MIROW guide on data quality assurance was released in 2013, and three programs said they are now using the newer data quality guide.

Indirect and Overall Use of Incoming Data Quality Guide

In addition to direct use of this guide by IIS programs, nearly half (n=20) IIS programs were classified as having indirect use of the Incoming Data Quality Guide. Nine of these programs use an IIS vendor that reported that this guide has specifically influenced how data quality is addressed in their products, and that these capabilities are standardized across their IIS clients. Eleven programs reported that their IIS had features consistent with the guide that pre-date the guide (or their review of the guide) or that they procured a new system that had features consistent with the guide. Three of these programs noted that they were involved in the guide's development, so that the guide reflects some of the things that they were doing already related to data quality. Two programs specifically mentioned use of an open source data quality assurance tool, which incorporates many MIROW consistent data quality checks for incoming electronic data. Combining direct and indirect use, 34 of the 45 IIS programs (76%) reported some use of the Incoming Data Quality Guide.

Impacts of Direct Use of Incoming Data Quality Guide

Among the direct users of the first Incoming Data Quality Guide, 12 IIS programs responded to whether the guide has been helpful; of those, 11 indicated that it has been helpful. The remaining program was involved with development of the guide and said that it was too difficult to distinguish whether it was the guide itself or going through the process of developing the guide that was helpful. Program comments related to the helpfulness of this guide, from the interviews or impact surveys, include:

"The guide was invaluable through our IIS transition and migrating of the old data."

"The guide has been very helpful in targeting both changes that could be made to system as well as improvements that can be made at the provider end."

"The guide helped to validate what we have practiced for all these years."

"The guide was very informative in terms of new person orientation."

"The guide has helped provide instructions to providers for submitting electronic data."

Positive Impacts

Among the direct users responding to the incoming data quality section of the detailed impact survey (n=12), positive impacts far outweighed the negative impacts (Table 6). The positive impacts noted most commonly were on the amount of time spent by the program developing the protocol for pre-certifying providers and with providers and EHR vendors on the process for submitting data electronically to the IIS. Two programs said use of the guide had a positive direct financial impact. One of these programs explained that using this guide has improved that data quality in their IIS, which has allowed them to justify the creation of a data quality coordinator position to sustain this degree of quality.

Among the direct users that responded to the general survey on the impact of using the Incoming Data Quality Guide (n=7), all impacts noted were positive. All felt that the guide has positively impacted their understanding of both best practice guidelines related to incoming data quality and how well their IIS reflects these best practices. In addition, all reported that the use of the guide positively impacted their ability to identify desired future changes to their IIS related to incoming data quality and to establish business processes for providers and EHR vendors related to incoming data quality. Among those for whom it was applicable (n=4), all cited positive impacts of guide use on their ability to specify desired functionality related to incoming data quality when transitioning to a new IIS. Six of 7 programs reported positive impacts of guide use on their ability to explain to providers and EHR vendors the rationale for the incoming data quality procedures in their IIS.

In an email response to the general survey, one program has found that the guide positively impacted their ability to understand what is being discussed with their IIS vendor and how the business rules will be applied within their IIS. Some further comments on positive impacts of using this guide from the broad evaluation interviews include:

"Using the guide has tremendously enhanced our ability to catch problems early, which has greatly reduced having to back out large quantities of data to clean up and reinsert."

"As a new IIS manager, it would have been hard to understand what business rules were needed in the system without the guide. Using the guide saved time by making it easier to create business rules and helped to validate some of what had already been doing already."

Negative Impacts

Two respondents to the detailed survey cited 3 negative impacts (2 by one program, 1 by another) on the amount of time spent by the program on certain data quality activities (Table 6). These impacts relate more to that fact that these data quality activities take up a significant amount of time rather than being an impact of use of the guide.

No Impacts or Unknown Impacts

Many respondents to the detailed survey indicated that the guide had either no direct financial impact on their program (n=4), or they did not know if it had a financial impact (n=5).

Table 6. Extent of Specific Impacts from Direct Use of Incoming Data Quality Guide, Detailed Impact Survey (n=12)

Extent to which use of Incoming Data Quality Guide impacted…	N[1]	Substantial Positive Impact	Some Positive Impact	No Impact	Some Negative Impact	Substantial Negative Impact	Don't Know	Not Applicable to IIS
The protocol for "pre-certifying" providers to submit data electronically to your IIS from EHRs	12	5	5	1	0	0	0	1
The amount of time spent by your program developing the protocol for "pre-certifying" providers to submit data electronically to your IIS from EHRs	11	5	6	0	0	0	0	0
The amount of time spent by your program with providers/EHR vendors on the process for submitting data electronically to your IIS	12	6	5	1	0	0	0	0
The protocol for validating data coming into your IIS	12	6	4	1	0	0	1	0
The amount of time spent by your program developing the protocol for validating data coming into your IIS	12	5	5	0	0	1	0	1
The amount of time spent by your program implementing the protocol for validating data coming into your IIS	12	6	3	1	0	0	1	1
The amount of time spent by your program cleaning data after it has been loaded into your IIS	12	6	3	1	0	2	0	0
The timeliness of vaccination doses reported to your IIS	12	4	3	5	0	0	0	0
The completeness of vaccination doses reported to your IIS	12	5	4	2	0	0	1	0
The accuracy of vaccination doses reported to your IIS	12	6	4	2	0	0	0	0
The degree to which your program uses the IIS to conduct reminder/recall	12	3	7	1	0	0	0	1
The degree to which providers use reminder/recall functions in your IIS	12	2	7	1	0	0	1	1
The accuracy of coverage assessments conducted using your IIS	12	1	9	0	0	0	0	2
The degree to which your program uses assessment functions/reports in your IIS	12	2	8	0	0	0	0	2
The degree to which providers use assessment functions/reports in your IIS	12	1	6	1	0	0	3	1
The degree to which providers use your IIS to produce immunization records for patients	12	4	5	1	0	0	1	1
A direct financial impact on your program	12	0	2	4	0	0	5	1

[1] Note that not all questions were answered by each respondent and therefore individual questions may have <12 respondents. Also, counts of responses to individual questions may sum to >12 because respondents could select all responses they felt applied.

Barriers to Direct Use of Incoming Data Quality Guide
Based on responses to the broad and in-depth evaluation interviews from 45 programs, some programs noted reasons for not using, or for delaying use, of the guide. Two programs noted that limited resources and staff were a factor, while another said that their "plates are really full." One program noted that implementing some of the business rules would hinder the timeliness of onboarding providers to submit data electronically, and another said that implementing some of the business rules is a lower priority (e.g., route and site of administration consistent with vaccine type).

Operational Consistency with Incoming Data Quality Guide
Based on responses to the broad and in-depth evaluation interviews from 44 programs, this section provides an overview of the processes that IIS programs have in place related to incoming data quality. The two main topics addressed in the Incoming Data Quality Guide are (1) the process for pre-certifying providers submitting data electronically to the IIS, and (2) the principles and business rules for conducting ongoing, pre-load validation of incoming data. The guide also recommends conducting periodic post-entry data checks across the IIS database.

Provider Pre-Certification
All programs for which we have information (41 of 44) have a process in place for pre-certifying electronic data submitters. The process is new for one program because they are still in the pilot stage of accepting incoming data from EHRs. One program noted that their state Health Information Exchange (HIE) is responsible for this process; seven programs mentioned that HIEs are involved in some way with electronic data exchange.

Before allowing data submitters to submit "live" data, the guide recommends several levels of data checks, including field-level checks on a sample file of data; file-level checks, looking for things like vaccinations matching appropriate age groups; and chart audits, to check whether data match the medical chart. Of the 7 programs that participated in the in-depth interviews, all are doing field-level checks, 3 are doing file-level checks, and none are doing chart audits. Two programs noted that they used to do chart audits, another said that they do them if the data seem particularly problematic, and another said they emphasize involvement of clinical personnel from the provider site in the pre-certification process.

For providers that submit data via the web-based user interface, 8 of 44 programs indicated that they do some sort of pre-certification or pre-testing of data for providers doing direct entry into the user interface, while another 2 programs said this would be a regional-level responsibility. Twenty-one programs do not pre-certify direct entry providers (though training is typically available), and there was no information for 13 programs. All programs (43 of 44 programs; no data for 1 program) reported that data quality for those that submit data via the user interface is largely done via edit checks programmed in for specific fields (e.g., cannot enter a vaccination date that occurs before the birth date).

Pre-Load Validation of Incoming Data
The guide outlines 13 principles and 32 business rules for validating incoming data quality. For those programs for which we have data (38 of 44), all are doing ongoing pre-load validation of electronically submitted data. Two programs noted that the extent of validation done by the IIS is very limited.

The 7 programs that participated in in-depth interviews were asked about implementation of a subset of high priority business rules related to incoming data quality. All validate vaccine type, vaccine encounter date, and patient date of birth for all incoming records of vaccine events. All 7 programs are able to implement the first 7 business rules (BR101-107), where applicable, with the exception of BR102 (vaccination encounter date should not be after the patient date of death) because a few do not have dates of death in their IIS.

Post-Entry Data Quality
Almost half of the programs (n=21) reported doing some sort of post-entry data quality checking, though some are only at the provider level (versus being system wide); 2 programs reported not being able to do this type of data checking and there was no information available for 20 programs. Six programs specifically mentioned using (n=2) or being in discussions about using (n=4) an open source data quality assurance tool for electronically submitted data.

A few other aspects related to incoming data quality noted by IIS programs:

- One program put all of their existing records through the data quality processes in their new system during the transition and are now working through issues identified (this was done separate from the live database).
- One program noted that they use trainers across the state to communicate errors to providers.
- One program had been giving EHR vendor-level approvals, such that all providers with that product could onboard, but realized that there are lots of provider-specific issues, so they have changed to pre-certifying at the provider level.
- One program puts the EHR vendor product through their data quality pre-certification process before it allows any of their providers to onboard.
- For another program, once an EHR vendor's product has been approved for one provider, the testing is less strict for other providers using the same product.
- Two programs noted that have developed and use data quality processes that are outside of their base IIS vendor product.

Extent to which Consistency with Guide is Known
IIS programs that were not direct users of this guide (n=21) typically did not know the extent to which their IIS is consistent with the Incoming Data Quality Guide, but six of these programs indicated having a general idea about consistency of their IIS with the guide.

Among direct users, several programs (n=11) reported having a general idea of how consistent their IIS is with the guide; two of these programs have assessed the degree to which their system is consistent with the guide. Nine programs said they do not know the extent to which their IIS is consistent with the guide, while information on this topic was not available for three programs.

Issues/Concerns with Incoming Data Quality
Based on responses to the broad and in-depth evaluation interviews from 45 programs, IIS programs raised a few issues related to incoming data quality in their IIS:

- Three programs noted that pre-certification/onboarding of providers to submit data electronically is a very time consuming and lengthy process.
- Two other programs noted that data quality in general takes up a lot of resources, and that you can always be doing more to improve data quality.
- Two programs noted that their focus has been on populating their IIS, and that they now need to focus more on data quality. One further explained that with no IIS reporting mandate, it is tricky to increase data quality without alienating providers.
- One program pointed out that EHR vendors are not checking rejection reports or response files to convey the information to their providers to fix the problems.
- One program noted that documenting inventory in the IIS makes data quality especially important.
- One program commented that electronic exchange data are of poorer quality than user interface data.

- One program said that it is difficult to implement business rules when HL7 messages do not contain the fields needed to apply those rules.
- Two programs raised issue related to HIEs. In one case, the HIE is responsible for HL7 submitters and only minimal quality assurance is done prior to data entering the IIS. Another program notes that their HIE onboards providers, and that data that comes in from the hub is hard to separate by provider.

3.5 Overall Comments on MIROW Guides

To close the broad evaluation interview, participants were asked to reflect on the overall MIROW process. Some illustrative comments on the value of the MIROW guides include:

> "Having best practices to fall back on is very helpful, especially in the medical world; physicians always want to see best practices."

> "So much of the groundwork is already there, takes guesswork out of some of the things that IIS are trying to accomplish."

> "Very helpful to have these guides for developing an RFP for a new IIS, and for using as a reference as the system is developed."

> "It's a worthwhile effort to have best practices at the national level. The issues are complex, and there are some things that can and should be standardized. At the same time, a balance must be struck between standardization and customization to meet IIS-specific needs."

Guide Formats

One program noted that having concrete, actionable principles and business rules presented in table format, make it much easier to follow and implement the guides, compared to general recommendations. Another program reported preferring the tabular format. Having best practice information presented in this way also may make it easier to measure the extent to which programs are implementing the guides. But there are downsides noted by IIS programs as well. Not all principles and business rules are equally important or would have the same impact on data quality as others. Not all are applicable for every IIS, and presenting them in a format that facilitates measurement can imply that things can and should be measured. Comparisons across IIS based on the number of "checked boxes" do not necessarily equate to one IIS being better, or having better data quality, than another.

A few programs addressed the value of having both the full guides and the mini guides. Two programs noted that they first use the mini guide, but go to the full guide if they want the history or more specifics. Another program finds the mini guides good for programmatic staff, while the full guides are useful for technical staff.

Many programs reported that they find the mini guides to be more accessible. One program noted that mini guides are a nice distillation of the full guides. Limited time was reported as a major barrier to being able to read and digest the full guides, given their length and complexity. A few programs noted that the domain models are hard to understand, and others thought that it is easier to understand the guides for those that were involved in guide development.

Suggestions

Some programs had suggestions for improving the guides or programs' understanding of the guides. A few programs noted that trainings or webinars on the MIROW guides could be helpful, such as focusing on a mini guide to help IIS staff digest the information and discuss what other programs doing. Another suggested a "MIROW Guide 101" training on how to interpret the documents, separate from the content, to orient managers and staff on navigating the guides. Another program noted that dissemination of guide information should take into account that the

audience sometimes goes beyond IIS (e.g., VFC staff). Other things that programs have found or would find helpful:

- Examples of how different IIS are doing things.
- Information from states that have recently worked with guides on what parts they implemented and what worked for them.
- Breaking up the guides into smaller steps, such as by highlighting the top few most important improvements that could make.
- A master table of contents across all guides, with all principles and business rules in one place with references to the relevant guides.
- Removal or separation of the details on the process of MIROW guide development from the content of the guides.
- A focus on "shorter" topics.

Finally, a few programs noted that the IIS world is constantly changing and that the guides should evolve as well. One program noted that when the guides were initially developed, data was not as timely getting into IIS; with the increase in electronic exchange, they felt that all of the guides should be reviewed to see whether they are adequately reflecting current issues.

3.6 Study Limitations

The results of this evaluation are subject to several important limitations. The primary means by which information was collected for this evaluation was through semi-structured interviews. Participants in the broad or in-depth evaluations may not have commented fully on all aspects of MIROW guide use, perceived benefits of use, or barriers to use that may have been experienced in their respective IIS jurisdiction. As a consequence, those aspects pertaining to MIROW guide use may be understated in our findings. Other limitations include:

Institutional Memory. Much of the data collected was based on self-report of the IIS program staff member(s), who may or may not have a complete or accurate institutional memory of the specifics related to use and implementation of the MIROW guides in their IIS. The IIS staff members who participated in this MIROW evaluation may have joined their team relatively recently and may not necessarily have participated in the development phase of their IIS. Similarly, staff may have commented on MIROW-related concepts as they pertain to an IIS platform that was previously in use by the jurisdiction and which has subsequently replaced by another system. These issues may be particularly relevant given the number of recent IIS manager and IIS system transitions.

Differentiation of Direct vs. Indirect Use of MIROW Guides. Our focus was on those with evidence of direct use, which was based on a demonstrated application of a MIROW guide, such as to define new functionality for an IIS development or procurement project. Indirect use, in which the IIS may be compliant with the MIROW guides, could not be fully quantified; although some IIS may have options for MIROW-compliant functions, the actual day-to-day application in IIS business processes could not necessarily be determined.

Verification of Operational Consistency. Use of the MIROW guides does not necessarily imply operational consistency with each of the best practices detailed in the guides. Some programs had difficulty clearly distinguishing patient-level deduplication from vaccination-level deduplication. For the first Incoming Data Quality Guide, the availability of the more recent data quality guide may have confounded our results, though many programs noted that they were waiting for the mini guide to be released before becoming familiar with the new data quality guide.

Impact Survey Responses. Specific to the impact surveys, respondents may not have always been able to distinguish the impact of guide use from the impact of functionality and business processes in their IIS related to guide content. Also, some respondents answered impact questions on guides for which we had not recorded any direct use based on the broad evaluation interview, and we were not able to clarify these discrepancies in all cases.

Impact of Non-MIROW Factors. The impact of MIROW guide use can be difficult to distinguish from other environmental changes that are occurring in the IIS world. For example, assessing the number of vaccine duplicates before and after implementation of the Vaccination-Level Deduplication Guide is confounded by the rapid increase in the number of EHRs submitting electronic data to IIS. Similarly, changes in use of reminder/recall by providers is confounded by changes in reminder/recall functionality that are not guide related, as well as by reminder/recall conducted centrally by state staff or for research purposes.

Financial Impacts. An objective of the MIROW Steering Committee for this evaluation was to document the impacts of the MIROW guides and in particular, to assess the financial impacts such as reduction in costs or the return on investment (ROI). Attaining this objective was not feasible for several reasons, including an inability to accurately track costs associated with adoption or even the timeframe in which the MIROW guide was actually implemented. The collection of all costs from IIS programs for personnel, operations, etc. was beyond the scope of this study. Understanding the costs associated with the Patient Status Guide would entail gathering the costs for the related IIS programming, provider staff time to set patient status, and jurisdiction-level staff time for reviewing and assigning patient status changes. In addition, an IIS program using an IIS vendor product that adopted MIROW guidelines would need to have some fraction of its development costs assigned to each IIS program that uses the product. Consequently, collection of these costs was not feasible in this study.

Note that a comparison of IIS programs with themselves pre-/post-adoption of the MIROW guide was considered, but this design requires a clear sense of if the guides were adopted and exactly when that occurred in order to establish pre-/post-MIROW guide comparison periods. However, not all IIS programs actively adopt the MIROW guides; some capabilities are incorporated directly into the IIS vendor products, and those capabilities may or may not be actively used by programs. Further, not all guide recommendations are fully implemented by IIS programs so a continuum of adoption may exist. Collectively, these issues preclude the ability to assign a specific cost or benefit to MIROW guide adoption.

4.0 DISCUSSION

Through our evaluation of the first 3 MIROW guides, we found that most IIS programs are familiar with the guides and that over half of the programs report direct use of the 3 guides. Types of direct use ranged from having the guides available as a reference on best practices to implementing changes to the IIS that align with these best practices.

Most guide use has occurred in the past few years, which may be partly a function of IIS maturity, as many programs have transitioned to new systems in recent years, and a growing awareness of the MIROW guides, based on dissemination efforts of AIRA and the MIROW Steering Committee. Many programs have a general idea of the extent to which their IIS is consistent with the guides, but few have formally assessed the extent of guide implementation.

Among direct users, the guides were widely considered to be helpful. Guide use was reported to have a range of positive impacts, including positive impacts on implementation of guide-specific concepts (e.g., capturing patient status, developing an algorithm for deduplicating vaccine events) to more downstream positive impacts on data quality. A few negative impacts of guide use were also noted, mainly related to the amount of time or resources initially needed to implement changes related to the guides.

Factors Affecting Guide Use

Direct use of the MIROW guides was found to be influenced by several factors, both internal and external to IIS programs. The maturity of an IIS program and systems' life cycle stage were often the impetus to employ the guides; an impending enhancement to an existing system, or the procurement process for a new system were often key trigger events. Procuring or developing a new IIS platform provides an ideal opportunity to obtain a product that is, by design, consistent with the guides. In contrast, long-standing IIS programs need to determine in what ways their IIS differs from best practice, determine what is feasible to change in their IIS, and then adapt their systems to include new functionality or business processes.

Importantly, the influences of the Meaningful Use incentives to encourage the wide adoption of electronic health record (EHR) systems were evident among many IIS programs. The potential benefits and challenges of EHR/IIS interoperability were widely reported as a driver behind data quality and business process concerns that were addressed by MIROW guide use. Although data quality was a key theme, the reported uses influenced by interoperability considerations involved each of the guides. Absent an impending need to modify or replace an IIS system, programs frequently referred to the MIROW guides as a best practices reference upon which their systems could be gauged.

Barriers to Use

IIS programs frequently described barriers to guide use; most often, the leading barriers were rooted in the pressures of competing IIS program priorities and the reality of resource and staff limitations. Much IIS funding is through federal grants and therefore priorities are often driven by grant requirements or other major initiatives. Recently, these activities include recording dose-level VFC eligibility status, deploying CDC's Vaccine Tracking Systems (VTrckS), and addressing providers' interest in meeting Meaningful Use requirements. Note that the emphasis placed on meeting Meaningful Use objectives has greatly increased interest in reporting electronically to IIS, which could trigger increased use of the Incoming Data Quality Guide. However, Meaningful Use activities also may require significant staff time and resources, which may detract from other IIS priorities or uses of the guides.

It is important to note that adopting functionality consistent with the guides can at times be in conflict with programmatic priorities. For example, implementing some of the data quality business rules could hinder provider onboarding by slowing down the process or reducing the number of organizations or EHRs that could meet those rules. IIS-related policies and laws can also affect the ability of an IIS program to implement certain components of the guide. In cases where provider reporting is not required, or patients must opt in to be included in the IIS, data completeness is often a major concern. For these programs, programmatic priorities tend to focus more on ways to increase the quantity of data reported to the IIS, and the more asked of providers for reporting data, the less likely they may be to report at all.

Degree of Business Process Complexity

One consideration pertaining to MIROW guide use is the extent to which the IIS process can be addressed by a centralized, automated solution versus a process that requires significant human intervention. Consequently, employing the MIROW data quality assurance guide was conceptually and operationally more straightforward for IIS programs than use of the Patient Status Guide. In the latter case, the programming complexities are significant and the challenges of provider training and use can be also be a substantial barrier. The volume and detail of information necessary to document these complexities may also be a barrier to some program staff, depending upon their specific training and experience. The highly detailed full MIROW guides can be a barrier to some; not all stakeholders necessarily need all levels of technical detail or have sufficient time to devote to assimilating the full guides. The mini guides were viewed very positively by IIS programs, and are often referred to first when looking for best practice information. The MIROW Steering Committee should continue to ensure that the mini

guides are an accurate distillation of the full guides, and that all of the most important points from the full guide are reflected. If applicable, the mini guides could note where it may be particularly important to be aware of additional information in the full guides.

Degree of IIS Vendor Involvement

The level of IIS vendor involvement varies across IIS programs and also may affect guide use. For in-house systems, IIS development and maintenance is done by internal staff, and any use of the guides must be self-initiated. On the other end of the spectrum, an IIS vendor that provides a standardized product across its clients takes on much of the responsibility to align its product with best practices. Individual IIS programs using this product should still be encouraged to familiarize themselves with the guides, as some of the best practices pertain to business processes that are not under the IIS vendor's control (e.g., provider use of patient status fields). In another variation, IIS vendors provide a base product to their clients, who have significant ability to customize the product, either themselves or by the IIS vendor. Though MIROW consistent functionality may be incorporated into the IIS vendor product to some degree, use of these functions varies across programs. Changes can be shared across users but are not always adaptable based on IIS-specific variations in the product that have been implemented over time.

Benefits of MIROW Guide Use

At the individual IIS level, programs reported a wide range of important benefits pertaining to MIROW guide use that may serve as incentives for increased participation by other IIS programs. The benefits experienced by IIS programs are two-fold: enabling them to better meet their essential public health goals, and to do so in an efficient manner. A fundamental requirement for IIS is maintain timely, accurate, and complete vaccination data. The essential IIS functions of vaccination surveillance (e.g., assessment) and outreach (e.g., reminder/recall) cannot be achieved without adequate data quality across these dimensions. Toward that goal, IIS programs reported numerous advantages to MIROW guide use that pertains to improved data quality across a wide range of perspectives. While the Incoming Data Quality Guide is directly aimed at processes to prevent data quality issues, both the Patient Status and Vaccination-Level Deduplication Guides can also have direct, positive impacts on the accuracy of IIS data.

Users of the MIROW guides also reported clear advantages to not "reinventing the wheel"; MIROW business processes could be directly adopted or modified as needed, which resulted in reduced IIS staff time. The benefits described by MIROW guide users include providing IIS programs with best practice-based processes and the corresponding time savings from avoiding staff labor devoted to created MIROW-supplied algorithms. Providing IIS programs with the detailed models to develop the necessary patient status categories, deduplication algorithms, and data quality assurance tools can not only save staff time for IIS development efforts, but program operations as well. MIROW guide users report reduced IIS staff burden for resolving data quality problems as well as for reconciling data with providers. These benefits will potentially have far-reaching consequences as initiatives such as EHR interoperability continue to expand and new provider sites come online for electronic data reporting.

There are also clear benefits nationally when aggregating the efficiencies experienced by individual IIS. As a whole, such efficiencies translate into cost avoidance and redundant efforts across IIS programs can be minimized. This is achieved across IIS programs since fewer IIS staff are needed to write requirements for IIS procurements or create processes that have already adopted by MIROW as a best practice. MIROW best practices are clearly aimed at maximizing data quality, which can further avoid devoting staff time to correcting data problems.

Looking ahead, IIS programs earlier in their life cycles may further benefit from MIROW guides as a catalyst to expedite system procurement and development based on best practices. As IIS

programs adopt new systems or embark upon enhancement projects, they may be able to reach a relatively high level of system maturity in a potentially shorter development period based on the cumulative knowledge base of the MIROW guides.

Conclusion

Overall, most IIS programs were familiar with the first three MIROW guides published and the majority have been able to directly use one or more of these guides. Types of direct use ranged from prompting changes to an existing IIS to helping develop provider education materials. Direct users generally considered the guides to be helpful and reported many positive impacts from use of the guides. Although guide use was generally high, some barriers to use were reported. Next steps could include developing strategies to address barriers to guide use and to further disseminate MIROW-based best practices in “user friendly” formats.

APPENDICES

Appendix A: List of Broad Evaluation Participants and In-depth Evaluation Status

Appendix B: Broad Evaluation Interview Guide

Appendix C: In-depth Evaluation Interview Guide

Appendix D: Detailed Impact Survey

Appendix E: General Impact Survey

Appendix F: List of Acronyms

Appendix A: List of Broad Evaluation Participants and In-depth Evaluation Status

(n=45)

Alaska[1]
Arizona
Arkansas
California
Colorado[1]
Connecticut[1]
Florida
Georgia[1]
Hawaii[1]
Idaho[1,2]
Iowa
Kansas[1,2]
Kentucky
Louisiana
Maine
Maryland
Massachusetts[1]
Michigan[1,2]
Minnesota[1,2]
Mississippi
Montana[1]
Nebraska[1]
Nevada
New Hampshire[1,3]
New Jersey
New Mexico
New York
New York City[1]
North Carolina[1]
North Dakota[1,2]
Ohio
Oregon[1,2]
Pennsylvania[1]
Philadelphia
Rhode Island
San Antonio
South Dakota[1]
Tennessee[1]
Texas
Utah[1]
Vermont[1]
Washington[1,2]
West Virginia
Wisconsin
Wyoming

Notes:
[1] Impact survey respondent (n=23)
[2] In-depth interview participant (n=7)
[3] IIS in procurement/development stage

Appendix B: Broad Evaluation Interview Guide

AIRA MIROW Evaluation: Broad Evaluation Interview Guide

The broad evaluation data collection addressed three main categories of information:

1. Relevant IIS background information;
2. Questions specific to each of the three guides being evaluated; and
3. Questions on the overall MIROW guide process.

Specifics for each category are described below.

Relevant IIS Background Information

IIS profile. The following information was used to create an IIS profile that interview participants were sent ahead of time and asked to verify:

- IIS name and jurisdiction
- Ages included in IIS
- Vendor platform and support, including a description of any recent vendor/platform changes
- Ability to send and receive HL7 v231 and HL7 v251 messages
- Child and adult consent policies
- Entities mandated to report to IIS, including patient ages for which reporting is required, if applicable
- Program involvement in the development of the three MIROW guides being evaluated and the MIROW Steering Committee
- Program involvement in other IIS-related initiatives (i.e., EHR Grantee, CDC 2D Barcodes Pilot, CDC Sentinel Site)
- 2012 IISAR data on IIS participation for children, adolescents, and adults

Other information. During the interview, other IIS background information was collected, including:

- Relationship of IIS program to Immunization Program (separate from or within; all staff in same department)
- Number of IIS staff
- Length of time with IIS (IIS manager/other staff on call)
- Year of IIS implementation and any recent or upcoming major changes, including motivation for switching to new product, if applicable
- Extent to which providers are required to report to IIS based on type of vaccine doses (public vs. private doses; children vs. adults)
- Plans for patient/consumer access to IIS

(2) <u>Guide-specific questions</u>. For each of the three guides, the broad evaluation interviews addressed the information below. Note, however, that based on the flow of the semi-structured interview, not all of this information may have been captured for each IIS.

- Familiarity with guide: Degree of familiarity with the guide
  - *If not familiar, skip to questions on guide-related functionality in IIS*
- Use of guide: Discuss whether and, if so, in what ways the program has used the guide, and whether any use planned.
  - *Classify as direct or indirect use.*
  - *If not used, skip to questions on guide-related functionality in IIS*
- If directly used, discuss:
  - Type of use (e.g., to implement new functionality, for provider education)
  - Extent to which guide was helpful
  - Whether used for a new / existing / former IIS
  - General timing of guide use (when, one-time / incremental / ongoing)
  - perceptions of overall impact of guide use (e.g., staff time/cost, data quality)
- Guide-related functionality: Discuss the general process for patient status / vaccination-level deduplication / incoming data quality in IIS, specifically:

  MOGE/Patient Status
  - Whether record patient status at the provider level
  - Extent to which patient status is available at the geographic jurisdiction level
  - Categories used to define patient status in IIS
  - Whether give providers instructions regarding use of patient status
  - Whether have rules/logic for which patient status designations should be included in reminder/recalls and coverage assessments
  - Whether IIS-based reminder/recall is done by providers and/or centrally

  Vaccination-level Deduplication
  - Whether have rules/logic in place to identify and resolve duplicate vaccinations
  - Whether have automated algorithm for deduplicating vaccines
  - Whether any vaccination deduplication is done manually (e.g., queue for manual review) and, if so, whether keep track of number of records in queue and/or trends in queue size
  - Maximum time window (in days) for selecting potential duplicates (e.g., 23 days)
  - Whether keep "best" record or consolidated/merged record when duplicates resolved
  - Whether vaccination deduplication process can be reversed

  Incoming Data Quality
  - Whether have process for "pre-certifying" electronic data submitters (e.g., testing sample file of incoming data)
  - Whether have any rules/logic for ongoing data quality checks that are run before data are loaded into IIS (i.e., pre-load validation)
  - How process differs for users of web interface (e.g., any testing of data prior to "live" entry, automated data entry edit checks)

- Whether conduct any routine data checks after data entered (e.g., running QA reports)
- Whether have a mechanism for assessing accuracy, timeliness, or completeness of incoming data (e.g., Nathan Bunker's DQA tool)?

General Questions

- Whether know the extent to which the IIS is consistent with the guide
- If made or making changes in IIS policy or process to be more consistent with guide, whether those changes made in house or by IIS vendor
- Challenges/issues with using guide or with addressing patient status / vaccination-level deduplication / incoming data quality

(3) Overall MIROW Questions. To wrap up the interviews, questions were asked regarding:

- Whether the formats of the MIROW guides are accessible
- Overall degree to which MIROW guides are helpful
- Suggestions for improvements to MIROW guideline content or process (e.g., development, structure, presentation, dissemination)

Appendix C: In-depth Evaluation Interview Guide

IN-DEPTH INTERVIEW PROTOCOL

*Items focus mainly on operational consistency and functionality. Impact questions are addressed via a Survey Monkey survey; responses to that survey will be clarified as needed during in-depth interviews. Questions that may have been at least partially addressed in the broad evaluation coded with **[B]**.*

IIS Characteristics

- Address any IIS characteristic items from broad evaluation that require clarification, if applicable (relevant columns: year implemented, reporting mandates, relationship of IIS to IZ Program, IIS staff count, length of time with IIS, IIS manager turnover)

MOGE Patient Status Guide

- Is patient status defined and maintained at the provider level? **[B]**
- Is patient status defined and maintained at the geographic/jurisdiction level? If so, is it maintained in a separate field or simply generated via reports? **[B]**
- Are the definitions of patient status at the provider and geographic/jurisdiction levels consistent with the guide (i.e., defined as shown in table below)? What guidance is given to providers on the patient status categories and rules for category transitions? **[B]**
  → *Get user guide/screenshots/other provider guidance describing categories if don't have already*

Status should be ↓ if…	Provider Level	Geographic Level
Active	An individual has: a. received an immunization from a provider, b. has been identified as a patient of a provider by a health plan, c. has been identified as a patient by a provider, or d. has been identified as a patient of a provider based on other medical information.	Documentation exists that the individual resides within the geographic jurisdiction.
Inactive-MOGE	There is documentation that a patient has: a. moved out of immediate area, b. gone to another practice, or c. moved with no forwarding address.	Documentation exists that the individual no longer resides in the geographic jurisdiction.
Inactive-Lost to follow-up	Attempts to contact an individual have been documented but there is no documented response received, or there is inadequate contact information for the individual.	
Inactive-permanently	The patient is deceased.	
Inactive-unspecified	A provider has determined that a patient is no longer active for immunization purposes but did not specify a reason.	N/A
Unknown	A patient has been made known to the IIS via an electronic interface without patient status being specified.	a. An individual ≥ 7 years of age has no documented immunizations in the IIS after their birth dose, or b. No contact or event (e.g., change to record) has been documented in an individual's IIS record for ≥10 years.

- Can you track the degree to which providers change patient status? If so, do you? Do providers utilize the patient status field(s)? Do they use it appropriately? **[B]**

- Are the patient status inclusion/exclusion options for reminder-recall and immunization coverage assessments consistent with the guide (i.e., defined as shown in table below)?
  → *Get screen shots if relevant*

	Level	Include	Exclude	Option
Reminder-Recall[1]	Provider	Active	All inactive categories: Inactive-MOGE Inactive-permanent Inactive-lost to follow-up Inactive-unspecified	Unknown
	Geographic[2]	Active	Inactive-MOGE Inactive-permanent Unknown	Inactive-lost to follow-up
Coverage Assessments	Provider	Active Unknown	All inactive categories: Inactive-MOGE Inactive-permanent Inactive-lost to follow-up Inactive-unspecified	
	Geographic[3]	Active Unknown Inactive-lost to follow-up	Inactive-MOGE Inactive-permanent	

Note: Opt-outs should be excluded from R/R, for IIS where applicable.

- Do providers utilize reminder-recall? Is any R/R done centrally? **[B]**
- Can you produce a report/query of the number of persons by patient status category at the provider and jurisdiction levels? If so, is this something you monitor?
- Is the patient status field used when running coverage assessments at the state level (vs. being independent of this field(s))?
- To what extent are patient status changes accomplished through electronic reporting (e.g., HL7)? If they come in blank/empty, what is the default?
- Do you use any adjunct methods to determine patient status, such as data from USPS, health plans, driver's license bureaus, or data from other states? **[B]** If so, how are these data reflected in the IIS?
- Follow-up on other data missing from broad evaluation, if applicable: **[B]**
  - Implicit use [*confirm our classification*]
  - Extent to which know whether consistent with MIROW
  - If direct use: used for new or existing IIS, timing of guide use, extent that guide helpful
  - If no direct use: reasons for not using
  - Whether any direct use planned
- Follow-up on responses from impact survey; refer also to initial discussions re: impact from broad evaluation, if applicable

Vaccination Deduplication Guide

- Is vaccine deduplication done for all incoming data prior to incorporation into the IIS? **[B]**
  → *Easy way to share algorithm? Relevant screenshots?*
- Is vaccine deduplication regularly performed for all records in the IIS (i.e., post entry)?
- Is there a window established for identifying records as potential duplicates? **[B]** Does this window differ for UI vs. electronically submitted data?
- When evaluating vaccine potential duplicates, is a match in some variables considered more important than others?
- As a general principle, is the vaccine deduplication algorithm more inclusive than exclusive (i.e., more likely to conclude that potential duplicates are different records)?
- Do you track whether records are administered vs. historical? If so, is this info used in the vaccine deduplication process?
- When resolving duplicate vaccines, do you select the "best" record and create a consolidated record? **[B]** If so, what do providers see?
- If there is a queue for manual review, is a written protocol followed when conducting manual review? Are you able to keep the queue at a manageable size?
- Do you involve providers in vaccine deduplication? **[B]**
- Do you track the number of records that are deduplicated?
- Have you ever looked at the number of false positives, false negatives, true matches, and true non-matches resulting from your vaccine deduplication process?
- Can your IIS decrement doses from inventory that come in via electronic exchange? **[B]**
- Follow-up on other data missing from broad evaluation, if applicable: **[B]**
  - Do you have rules/logic in place to identify and resolve duplicate vaccinations?
  - Is any part of the vaccine deduplication process automated?
  - Is any part of the vaccine deduplication process done manually? If so, do you track the number of records in this queue and/or trends in queue size?
  - Can the vaccine deduplication process be reversed/are there audit trails in place?
  - Implicit use [*confirm our classification*]
  - Extent to which know whether consistent with MIROW
  - If direct use: used for new or existing IIS, timing of guide use, extent that guide helpful
  - If no direct use: reasons for not using
  - Whether any direct use planned
- Follow-up on responses from impact survey; refer also to initial discussions re: impact from broad evaluation, if applicable

DQA Guide (2008 version)

Pre-certification of Data Submitters

- Do you have a process for pre-certifying providers to submit data to the IIS? **[B]**
  - Does it vary by mode of data submittal? **[B]**
  - What modes of data submittal do you currently accept (e.g., flat file, HL7, UI)?
  - From which types of sources do you currently accept data (e.g., billing, Vital Records)?
- Is the process for pre-certifying providers consistent with the guide (i.e., follows the steps below)?
  - Field-level checks: Do you test a sample file of real data based on standard field- and record-level checks done on regularly submitted data? **[B]**
  - File-level checks: Do you check to see if vaccinations match with appropriate age groups? Do you check to see whether vaccine distributions are appropriate for the provider type (meaning that some type of provider profile is maintained)?
  - Chart audit: Do you compare a random sample of patients from the sample file to each patient's medical chart?
  - Do you periodically conduct data checks on a subset of the IIS database to identify data quality or actual immunization practice problems (i.e., post-entry, IIS-level QA activities)? **[B]**

Pre-load Validation of Incoming Data

- Do you have an ongoing process for validating incoming data? **[B]**
  - Are the criteria used to validate incoming data the same regardless of how data have been reported to the IIS? How does the process differ for electronic submittals vs. UI? **[B]**
- Are vaccine type, vaccine encounter date, and patient DOB validated for all incoming records (of vaccine events)? Does this vary by mode of data submittal?
- Do you follow the business rules below when validating incoming data? Differ by UI vs. electronic exchange? *Note that some of these were revised in new DQ guide (see last page).*

BR101	Vaccination Encounter Date must not be before Patient Date of Birth.
BR102	Vaccination Encounter Date should not be after the Patient Date of Death.
BR103	Vaccination Encounter Date must be less than or equal to the Report Submission Date.
BR104	The minimum/mandatory set of data items for **Vital Records** must include: Patient Date of Birth, Patient First and Last Name, Birth Certificate Number, Birth Facility (name, address, county), Gender, Mother's First, Last, and Maiden Name.
BR105	The minimum/mandatory set of data items for **Provider Health Records** must include: Provider Organization Name/ID, Patient First and Last Name, Patient Date of Birth, Vaccine Encounter Date, Vaccine Type.
BR106	The minimum/mandatory set of data items for **Electronic Medicaid/Billing Records** must include: Provider Organization Name/ID, Patient First and Last Name, Patient Date of Birth, Vaccine Encounter Date, Vaccine Type.
BR107	Every administered vaccine should be recorded as a single vaccination event.

- Are you able to track quality indicators for incoming data (e.g., using NB's tool), such as:
  - Timeliness – e.g., average elapsed days from vax admin date until data reporting;
  - Completeness – extent to which field are populated (e.g., patient data, vaccine type)
  - Accuracy – e.g., degree to which unrecognized data are reported

- Follow-up on other data missing from broad evaluation, if applicable: **[B]**
  - Implicit use [*confirm our classification*]
  - Extent to which know whether consistent with MIROW
  - If direct use: used for new or existing IIS, timing of guide use, extent that guide helpful
  - If no direct use: reasons for not using
  - Whether any direct use planned
- Follow-up on responses from impact survey; refer also to initial discussions re: impact from broad evaluation, if applicable

Changes to BRs 101-107 in 2013 DQ MIROW guide

BR104	The minimum/mandatory set of data items for **Vital Records** must include: Patient Date of Birth, Patient First and Last Name, Birth Certificate Number, Birth Facility (name, address, county), Gender, Mother's First, Last, and Maiden Name.
BR104	The minimum/mandatory set of data items for **demographics-only submissions** must include: IIS-AO ID (Recorder), Patient Date of Birth, Patient Name-First, Patient Name-Last, Birth Certificate Number, Birth Facility (code, name, address), Gender.
BR105	The minimum/mandatory set of data items for **Provider Health Records** must include: Provider Organization Name/ID, Patient First and Last Name, Patient Date of Birth, Vaccine Encounter Date, Vaccine Type.
BR105R1	The minimum/mandatory set of data items **for "administered" vaccination event submission** must include: IIS-AO ID (Vaccinator/Recorder), Patient Name, First, Patient Name, Last, Patient Date of Birth, Vaccination Encounter Date, Vaccine Type, Administered/Historical Indicator = "Administered", Lot Number
BR105R2	The minimum/mandatory set of data items for **"historical" vaccination event submission** must include: Patient Name, First, Patient Name, Last, Patient Date of Birth, Vaccination Encounter Date, Vaccine Type, Administered/Historical Indicator = "Historical"
~~BR106~~	~~The minimum/mandatory set of data items for **Electronic Medicaid/Billing Records** must include: Provider Organization Name/ID, Patient First and Last Name, Patient Date of Birth, Vaccine Encounter Date, Vaccine Type.~~

Appendix D: Detailed Impact Survey

Survey on Impacts of MIROW Guide Use 2014

Survey on Impacts of MIROW Guide Use

Thank you for your continued participation in our evaluation of MIROW guide use and impacts, which we are conducting on behalf of the American Immunization Registry Association (AIRA). By completing this survey, your IIS program will be entered into a raffle for a Starbucks gift basket.

Please read before responding:

This survey asks about your perceptions of the impacts resulting from your IIS program's use of the first three MIROW guides. To answer the questions, keep in mind:

- Your response to a particular item can indicate that both positive and negative impacts were experienced, if applicable.
- If you are unsure of the impacts of guide use for a given item, mark "Don't Know".
- If your IIS does not support a given feature or the item does not pertain to your IIS, mark "Not Applicable to our IIS".
- If a particular guide did not prompt any action on the part of your IIS (see more details in the email with the survey link), you can skip the questions in the section pertaining to that guide.
- Explanation of terms used in survey questions:
    - "Your program" means the programmatic unit most relevant for the IIS. In cases where the IIS is separate from the immunization program, "your program" could be just the IIS program. For IIS that are integrated within the immunization program, "your program" can be interpreted more broadly.
    - "Providers" includes both public and private providers.

On the last page of the survey, please provide the name and email address for the person we should contact if we have follow-up questions. If your program is selected as a gift basket recipient, we will contact this person to confirm the mailing address for your program.

Thank you for your input!

The CHEAR Team

Survey on Impacts of MIROW Guide Use 2014

Patient Status

The questions in this section ask about the impact of your program's **USE of the MIROW guide on patient status**. Please answer for impacts specific to use of this guide (i.e., not for impacts more generally related to patient status in your IIS). You can select both positive and negative impacts, if applicable.

To what extent do you believe that use of the MIROW guide on *patient status* by your IIS has impacted:

	Substantial Positive Impact	Some Positive Impact	No Impact	Some Negative Impact	Substantial Negative Impact	Don't know	Not Applicable to our IIS
1. The ability to capture patient status at the provider level in your IIS	☐	☐	☐	☐	☐	☐	☐
2. The ability to capture patient status at the jurisdictional level in your IIS	☐	☐	☐	☐	☐	☐	☐
3. The categories used to define patient status in your IIS	☐	☐	☐	☐	☐	☐	☐
4. The protocol for when it is appropriate to change a patient's status in your IIS	☐	☐	☐	☐	☐	☐	☐
5. The amount of time spent by your program developing the protocol for capturing patient status in your IIS	☐	☐	☐	☐	☐	☐	☐
6. The amount of time spent by your program implementing the protocol for capturing patient status in your IIS	☐	☐	☐	☐	☐	☐	☐

Survey on Impacts of MIROW Guide Use 2014

To what extent do you believe that use of the MIROW guide on *patient status* by your IIS has impacted:

	Substantial Positive Impact	Some Positive Impact	No Impact	Some Negative Impact	Substantial Negative Impact	Don't know	Not Applicable to our IIS
7. The rules/logic used for which patient status categories to include for reminder/recall in your IIS	☐	☐	☐	☐	☐	☐	☐
8. The rules/logic used for which patient status categories to include in coverage assessments in your IIS	☐	☐	☐	☐	☐	☐	☐
9. The amount of time spent by your program educating providers about use of patient status in your IIS	☐	☐	☐	☐	☐	☐	☐
10. The amount of time spent by your program to monitor appropriate use of patient status in your IIS	☐	☐	☐	☐	☐	☐	☐
11. The amount of time spent by your program addressing data quality problems related to patient status in your IIS	☐	☐	☐	☐	☐	☐	☐
12. The timeliness with which providers reflect patient status changes in your IIS	☐	☐	☐	☐	☐	☐	☐
13. The proportion of actual patient status changes that providers record in your IIS (i.e., completeness)	☐	☐	☐	☐	☐	☐	☐
14. The accuracy of patient status for provider sites in your IIS	☐	☐	☐	☐	☐	☐	☐

Survey on Impacts of MIROW Guide Use 2014

To what extent do you believe that use of the MIROW guide on *patient status* by your IIS has impacted:

	Substantial Positive Impact	Some Positive Impact	No Impact	Some Negative Impact	Substantial Negative Impact	Don't know	Not Applicable to our IIS
15. The accuracy of patient status for geographic jurisdictions (e.g., county, state) in your IIS	☐	☐	☐	☐	☐	☐	☐
16. The degree to which your program uses the IIS to conduct reminder/recall	☐	☐	☐	☐	☐	☐	☐
17. The degree to which providers use reminder/recall functions in your IIS	☐	☐	☐	☐	☐	☐	☐
18. The ability to conduct coverage assessments using your IIS	☐	☐	☐	☐	☐	☐	☐
19. The degree to which your program uses assessment functions/reports in your IIS	☐	☐	☐	☐	☐	☐	☐
20. The degree to which providers use assessment functions/reports in your IIS	☐	☐	☐	☐	☐	☐	☐
21. A direct financial impact on your program	☐	☐	☐	☐	☐	☐	☐

22. Please briefly describe any other impacts of using the MIROW patient status guide, if relevant. Examples of other impacts include impacts on IIS procurement efforts or on other programs (e.g., state information technology (IT) department):

23. Additional comments on the questions in this section:

Survey on Impacts of MIROW Guide Use 2014

Vaccination Deduplication

The questions in this section ask about the impact of your program's **USE of the MIROW guide on vaccination deduplication**. Please answer for impacts specific to use of this guide (i.e., not for impacts more generally related to vaccination deduplication in your IIS). You can select both positive and negative impacts, if applicable.

To what extent do you believe that use of the MIROW guide on *vaccination level deduplication* by your IIS has impacted:

	Substantial Positive Impact	Some Positive Impact	No Impact	Some Negative Impact	Substantial Negative Impact	Don't know	Not Applicable to our IIS
1. The protocol for addressing duplicate vaccinations in your IIS	☐	☐	☐	☐	☐	☐	☐
2. The amount of time spent by your program developing the protocol for addressing duplicate vaccinations in your IIS	☐	☐	☐	☐	☐	☐	☐
3. The amount of time spent by your program implementing the protocol for addressing duplicate vaccinations in your IIS	☐	☐	☐	☐	☐	☐	☐
4. The efficiency of identifying duplicate vaccinations in your IIS	☐	☐	☐	☐	☐	☐	☐
5. The number of duplicate vaccinations reconciled in your IIS	☐	☐	☐	☐	☐	☐	☐
6. The amount of time spent by your program to reconcile duplicate vaccinations in your IIS	☐	☐	☐	☐	☐	☐	☐
7. The timeliness of vaccination doses reported to your IIS	☐	☐	☐	☐	☐	☐	☐
8. The completeness of vaccination doses reported to your IIS	☐	☐	☐	☐	☐	☐	☐

Survey on Impacts of MIROW Guide Use 2014

To what extent do you believe that use of the MIROW guide on *vaccination level deduplication* by your IIS has impacted:

	Substantial Positive Impact	Some Positive Impact	No Impact	Some Negative Impact	Substantial Negative Impact	Don't know	Not Applicable to our IIS
9. The accuracy of vaccination doses reported to your IIS	☐	☐	☐	☐	☐	☐	☐
10. The degree of provider confidence in vaccine forecasting (i.e., which vaccines are due/overdue)	☐	☐	☐	☐	☐	☐	☐
11. The degree to which your program uses the IIS to conduct reminder/recall	☐	☐	☐	☐	☐	☐	☐
12. The degree to which providers use reminder/recall functions in your IIS	☐	☐	☐	☐	☐	☐	☐
13. The ability to conduct coverage assessments using your IIS	☐	☐	☐	☐	☐	☐	☐
14. The accuracy of coverage assessments conducted using your IIS	☐	☐	☐	☐	☐	☐	☐
15. The degree to which your program uses assessment functions/reports in your IIS	☐	☐	☐	☐	☐	☐	☐
16. The degree to which providers use assessment functions/reports in your IIS	☐	☐	☐	☐	☐	☐	☐
17. The degree to which providers use your IIS to produce immunization records for patients	☐	☐	☐	☐	☐	☐	☐
18. A direct financial impact on your program	☐	☐	☐	☐	☐	☐	☐

19. Please briefly describe any other impacts of using the MIROW vaccination deduplication guide, if relevant. Examples of other impacts include impacts on IIS procurement efforts or on other programs (e.g., state information technology (IT) department):

20. Additional comments on the questions in this section:

Survey on Impacts of MIROW Guide Use 2014

Incoming Data Quality

The questions in this section ask about the impact of your program's **USE of the first MIROW guide on incoming data quality**. Please answer for impacts specific to use of this guide (i.e., not for impacts more generally related to incoming data quality in your IIS). You can select both positive and negative impacts, if applicable.

To what extent do you believe that use of the initial MIROW guide on *incoming data quality* by your IIS has impacted:

	Substantial Positive Impact	Some Positive Impact	No Impact	Some Negative Impact	Substantial Negative Impact	Don't know	Not Applicable to our IIS
1. The protocol for "pre-certifying" providers to submit data electronically to your IIS from EHRs	☐	☐	☐	☐	☐	☐	☐
2. The amount of time spent by your program developing the protocol for "pre-certifying" providers to submit data electronically to your IIS from EHRs	☐	☐	☐	☐	☐	☐	☐
3. The amount of time spent by your program with providers / EHR vendors on the process for submitting data electronically to your IIS	☐	☐	☐	☐	☐	☐	☐
4. The protocol for validating data coming into your IIS	☐	☐	☐	☐	☐	☐	☐
5. The amount of time spent by your program developing the protocol for validating data coming into your IIS	☐	☐	☐	☐	☐	☐	☐
6. The amount of time spent by your program implementing the protocol for validating data coming into your IIS	☐	☐	☐	☐	☐	☐	☐
7. The amount of time spent by your program cleaning data after it has been loaded into your IIS	☐	☐	☐	☐	☐	☐	☐

Survey on Impacts of MIROW Guide Use 2014

To what extent do you believe that use of the initial MIROW guide on *incoming data quality* by your IIS has impacted:

	Substantial Positive Impact	Some Positive Impact	No Impact	Some Negative Impact	Substantial Negative Impact	Don't know	Not Applicable to our IIS
8. The timeliness of vaccination doses reported to your IIS	☐	☐	☐	☐	☐	☐	☐
9. The completeness of vaccination doses reported to your IIS	☐	☐	☐	☐	☐	☐	☐
10. The accuracy of vaccination doses reported to your IIS	☐	☐	☐	☐	☐	☐	☐
11. The degree to which your program uses the IIS to conduct reminder/recall	☐	☐	☐	☐	☐	☐	☐
12. The degree to which providers use reminder/recall functions in your IIS	☐	☐	☐	☐	☐	☐	☐
13. The accuracy of coverage assessments conducted using your IIS	☐	☐	☐	☐	☐	☐	☐
14. The degree to which your program uses assessment functions/reports in your IIS	☐	☐	☐	☐	☐	☐	☐
15. The degree to which providers use assessment functions/reports in your IIS	☐	☐	☐	☐	☐	☐	☐
16. The degree to which providers use your IIS to produce immunization records for patients	☐	☐	☐	☐	☐	☐	☐
17. A direct financial impact on your program	☐	☐	☐	☐	☐	☐	☐

18. Please briefly describe any other impacts of using the first MIROW incoming data quality guide, if relevant. Examples of other impacts include impacts on IIS procurement efforts or on other programs (e.g., state information technology (IT) department):

19. Additional comments on the questions in this section:

Survey on Impacts of MIROW Guide Use 2014

***Please provide the name and email address for the person we should contact if we have follow-up questions. If your program is selected as a gift basket recipient, we will contact this person to confirm the mailing address for your program.**

Name

Email

Survey on Impacts of MIROW Guide Use 2014

Thank you for your input to this survey. Your responses will provide important information to help enrich our MIROW evaluation findings.

Appendix E: General Impact Survey

Mini-Survey on Impacts of MIROW Guide Use 2014

Survey on Impacts of MIROW Guide Use

Thank you for your continued participation in our evaluation of MIROW guide use and impacts, which we are conducting on behalf of the American Immunization Registry Association (AIRA). By completing this survey, your IIS program will be entered into a raffle for a Starbucks gift basket.

Please read before responding:
This survey asks about your perceptions of the impacts resulting from your IIS program's use of the first three MIROW guides. To answer the questions, keep in mind:

- Your response to a particular item can indicate that both positive and negative impacts were experienced, if applicable.
- If you are unsure of the impacts of guide use for a given item, mark "Don't Know".
- If your IIS does not support a given feature or the item does not pertain to your IIS, mark "Not Applicable to our IIS".
- If a particular guide did not prompt any action on the part of your IIS (see more details in the email with the survey link), you can skip the questions in the section pertaining to that guide.
- Explanation of terms used in survey questions:
    - "Your program" means the programmatic unit most relevant for the IIS. In cases where the IIS is separate from the immunization program, "your program" could be just the IIS program. For IIS that are integrated within the immunization program, "your program" can be interpreted more broadly.
    - "Providers" includes both public and private providers.

On the last page of the survey, please provide the name and email address for the person we should contact if we have follow-up questions. If your program is selected as a gift basket recipient, we will contact this person to confirm the mailing address for your program.

Thank you for your input!

The CHEAR Team

Mini-Survey on Impacts of MIROW Guide Use 2014

Patient Status

The questions in this section ask about the impact of your program's **USE of the MIROW guide on patient status**. Please answer for impacts specific to use of this guide (i.e., not for impacts more generally related to patient status in your IIS). You can select both positive and negative impacts, if applicable.

To what extent do you believe that use of the MIROW guide on *patient status* by your IIS has impacted:

	Substantial Positive Impact	Some Positive Impact	No Impact	Some Negative Impact	Substantial Negative Impact	Don't know	Not Applicable to our IIS
1. Your program's understanding of best practice guidelines related to patient status	☐	☐	☐	☐	☐	☐	☐
2. Your program's understanding of how well your IIS reflects best practices related to patient status	☐	☐	☐	☐	☐	☐	☐
3. Your program's ability to identify desired future changes to your IIS related to patient status	☐	☐	☐	☐	☐	☐	☐
4. Your program's ability to specify desired patient status functionality when transitioning to a new IIS	☐	☐	☐	☐	☐	☐	☐
5. Your program's ability to establish business processes for providers to follow related to patient status	☐	☐	☐	☐	☐	☐	☐
6. Your program's ability to explain to providers the rationale for how patient status should be addressed in your IIS	☐	☐	☐	☐	☐	☐	☐

7. Please briefly describe any other impacts of using the MIROW patient status guide, if relevant. Examples of other impacts include impacts on IIS procurement efforts or on other programs (e.g., state information technology (IT) department):

8. Additional comments on the questions in this section:

Mini-Survey on Impacts of MIROW Guide Use 2014

Vaccination Deduplication

The questions in this section ask about the impact of your program's **USE of the MIROW guide on vaccination deduplication**. Please answer for impacts specific to use of this guide (i.e., not for impacts more generally related to vaccination deduplication in your IIS). You can select both positive and negative impacts, if applicable.

To what extent do you believe that use of the MIROW guide on *vaccination level deduplication* by your IIS has impacted:

	Substantial Positive Impact	Some Positive Impact	No Impact	Some Negative Impact	Substantial Negative Impact	Don't know	Not Applicable to our IIS
1. Your program's understanding of best practice guidelines related to deduplicating vaccinations	☐	☐	☐	☐	☐	☐	☐
2. Your program's understanding of how well your IIS reflects best practices related to deduplicating vaccinations	☐	☐	☐	☐	☐	☐	☐
3. Your program's ability to identify desired future changes to your IIS related to deduplicating vaccinations	☐	☐	☐	☐	☐	☐	☐
4. Your program's ability to specify desired functionality for deduplicating vaccinations when transitioning to a new IIS	☐	☐	☐	☐	☐	☐	☐

5. Please briefly describe any other impacts of using the MIROW vaccination deduplication guide, if relevant. Examples of other impacts include impacts on IIS procurement efforts or on other programs (e.g., state information technology (IT) department):

6. Additional comments on the questions in this section:

Mini-Survey on Impacts of MIROW Guide Use 2014

Incoming Data Quality

The questions in this section ask about the impact of your program's **USE of the first MIROW guide on incoming data quality**. Please answer for impacts specific to use of this guide (i.e., not for impacts more generally related to incoming data quality in your IIS). You can select both positive and negative impacts, if applicable.

To what extent do you believe that use of the initial MIROW guide on *incoming data quality* by your IIS has impacted:

	Substantial Positive Impact	Some Positive Impact	No Impact	Some Negative Impact	Substantial Negative Impact	Don't know	Not Applicable to our IIS
1. Your program's understanding of best practice guidelines related to incoming data quality	☐	☐	☐	☐	☐	☐	☐
2. Your program's understanding of how well your IIS reflects best practices related to incoming data quality	☐	☐	☐	☐	☐	☐	☐
3. Your program's ability to identify desired future changes to your IIS related to incoming data quality	☐	☐	☐	☐	☐	☐	☐
4. Your program's ability to specify desired functionality related to incoming data quality when transitioning to a new IIS	☐	☐	☐	☐	☐	☐	☐
5. Your program's ability to establish business processes for providers/EHR vendors to follow related to incoming data quality	☐	☐	☐	☐	☐	☐	☐
6. Your program's ability to explain to providers/EHR vendors the rationale for the incoming data quality procedures in your IIS	☐	☐	☐	☐	☐	☐	☐

7. Please briefly describe any other impacts of using the first MIROW incoming data quality guide, if relevant. Examples of other impacts include impacts on IIS procurement efforts or on other programs (e.g., state information technology (IT) department):

8. Additional comments on the questions in this section:

Mini-Survey on Impacts of MIROW Guide Use 2014

Mini-Survey on Impacts of MIROW Guide Use 2014

***Please provide the name and email address for the person we should contact if we have follow-up questions. If your program is selected as a gift basket recipient, we will contact this person to confirm the mailing address for your program.**

Name

Email

Mini-Survey on Impacts of MIROW Guide Use 2014

Thank you for your input to this survey. Your responses will provide important information to help enrich our MIROW evaluation findings.

Appendix F: List of Acronyms

Appendix F: List of Acronyms

2D	Two dimensional
AIRA	American Immunization Registry Association
BR	Business rule
CDC	Centers for Disease Control and Prevention
EHR	Electronic health record
HIE	Health information exchange
HL7	Health Level 7
IIS	Immunization information system
IISAR	Immunization Information System Annual Report
LHD	Local health department
MIROW	Modeling of Immunization Registry Operations Work Group
MOGE	Moved or gone elsewhere
NCOA	National Change of Address
RFP	Request for proposal
ROI	Return on investment
SOW	Statement of work
VFC	Vaccines for Children
VTrckS	Vaccine Tracking System
WIR	Wisconsin Immunization Registry