

Recommended Immunization Schedule for Children Aged 0 Through 18 Years of Age - UNITED STATES, 2012

... includes recommendations in effect as of... dose not administered at the recommend... administered at a subsequent visit, when indicat... of a combination vaccine generally is preferre... of its equivalent component vaccines. Vacc... consult the relevant Advisory Committee... statement for detailed recommen... (ACIP) at <http://www.cdc.gov/vaccines/pubs/acip>... significant adverse events that follow vacc... reported to the Vaccine Adverse Event Report... (http://www.vaers.hhs.gov) or by teleph...

The Recommended Immunization Schedule for Children Aged 0 Through 18 Years of Age is available at www.cdc.gov/vaccines/imz/. For more information, contact the Advisory Committee on Immunization Practices (ACIP) at www.cdc.gov/vaccines/imz/, the American Academy of Pediatrics (AAP) at <http://www.aap.org>, or the American Academy of Family Physicians (AAFP) at <http://www.aafp.org>.



MMWR

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General Recommendations on Immunization

Recommendations of the Advisory Committee on Immunization Practices (ACIP)

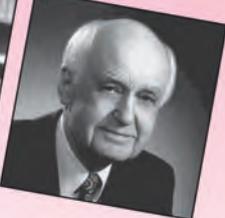


Continuing Education Examination available at <http://www.cdc.gov/mmwr/cme/conted.html>



U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Immunology and Prevention of Preventable Diseases



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Clinical Decision Support for Immunization (CDSi)



U.S. Department of Health and Human Services
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Immunization clinical decision support (CDS), more commonly referred to as evaluation and forecasting, is an automated process that determines the recommended immunizations needed for a patient and delivers those recommendations to the healthcare provider. Health Information Systems (HIS), which include Immunization Information Systems (IIS), Electronic Health Records (EHRs), and Health Information Exchanges (HIEs), create CDS tools based on schedules and guidelines developed by the Advisory Committee on Immunization Practices (ACIP), a federal advisory committee responsible for providing expert external advice and guidance on the use of vaccines and related agents for control of vaccine-preventable disease in the United States. ACIP recommendations include age for vaccine administration, number of doses, dosing interval, and precautions and contraindications.

After ACIP recommendations are published, technical and clinical subject matter experts (SMEs) work to interpret and integrate them into their CDS engines. New ACIP schedule changes are currently communicated only through scientific language, in publications like the Morbidity and Mortality Weekly Report (MMWR) and the Epidemiology and Prevention of Vaccine-Preventable Diseases (“The Pink Book”). The translation of that scientific language into technical logic that can be processed within CDS engines is a time-consuming and complex process that happens mostly independently within the different HIS. Because interpretation of clinically-written ACIP recommendations can be challenging, CDS engine outputs often vary and do not always match the expectations of clinical SMEs.

The Clinical Decision Support for Immunization (CDSi) Project

In an effort to harmonize the outcomes of existing CDS tools, the Immunization Information System Support Branch (IISSB) at the Centers for Disease Control and Prevention (CDC) funded a project to develop a logic specification for the childhood and adolescent immunization schedules. The goals of the project included:

- Increasing the accuracy and consistency of immunization evaluation and forecasting
- Improving the ease of developing and maintaining immunization CDS products
- Improving the process of updating CDS logic with new and/or changed ACIP recommendations

Improving CDS engines ultimately ensures that patients receive proper immunizations. i.e. “the right immunization at the right time”

As part of this project, an expert panel was formed in April 2011, consisting of SMEs and expert reviewers from:

- CDC Public Health Informatics and Technology Program Office (PHITPO)
- American Immunization Registry Association (AIRA)
- Indian Health Service (IHS)
- Electronic Health Record (EHR) vendors
- HIS programs and vendors
- Academic institutions

This panel was divided into the following three workgroups which met regularly to develop resources in support of the project’s goals:

- **Logic Specification Panel (LSP)**– Developed the **Logic Specification for ACIP Recommendations**, which captures ACIP recommendations in an unambiguous manner and improves both the uniform representation of vaccine decision guidelines, as well as the ability to automate vaccine evaluation and forecasting.
- **Validation and Testing Panel (VTP)**– Created the **CDSi Testing Methodology** to extensively test the accuracy of CDS logic representation within CDS engines.
- **Process, Communication and Sustainability Panel (PCSP)**– Produced a **Sustainability Plan** to ensure the long-term viability of the CDSi resources.

Scope

The vaccine groups in scope are those routinely recommended by ACIP for healthy children from birth through 18 years, including:

Vaccine Groups			
<ul style="list-style-type: none"> Diphtheria, Tetanus, and Pertussis/Tetanus-diphtheria (DTaP, Tdap, Td) 	<ul style="list-style-type: none"> Haemophilus influenzae type B (Hib) 	<ul style="list-style-type: none"> Meningococcal conjugate vaccine (MCV) 	<ul style="list-style-type: none"> Polio
<ul style="list-style-type: none"> Hepatitis A 	<ul style="list-style-type: none"> Human papillomavirus (HPV) 	<ul style="list-style-type: none"> Measles, Mumps, Rubella (MMR) 	<ul style="list-style-type: none"> Rotavirus
<ul style="list-style-type: none"> Hepatitis B 	<ul style="list-style-type: none"> Influenza (Flu) 	<ul style="list-style-type: none"> Pneumococcal conjugate vaccine (PCV) 	<ul style="list-style-type: none"> Varicella

Additional items in scope include:

Item	Notes
<ul style="list-style-type: none"> Current ACIP recommendations with clarifications 	ACIP recommendations exist in a few different formats. An appendix in the Logic Specification lists these.
<ul style="list-style-type: none"> Compromised/sub-potent/expired doses Vaccine recalls Wrong vaccine formulations Underlying conditions related to contraindications listed in the General Recommendations The 4-day grace period 	

Items currently out of scope include:

Item	Notes
<ul style="list-style-type: none"> Non-ACIP published rules <ul style="list-style-type: none"> State law variations from ACIP Local school schedules Rules published by other organizations Rules published in other countries 	While not addressed specifically, the Logic Specification was developed to accommodate these different rules. Supporting data in the specification can be adjusted by implementers to cover these variations from the ACIP recommendations.
<ul style="list-style-type: none"> Adult vaccines Underlying conditions related to precautions and special indications High/increased/special risk series (e.g. Hib past 5 years, MCV HIV series) Immune Globulin (IG) Route and body site of administration Travel vaccines Vaccine shortages Non-FDA approved vaccines (e.g. those used in clinical trial) A schedule without a 4-day grace period 	These items are currently excluded from scope but are candidates for future consideration.



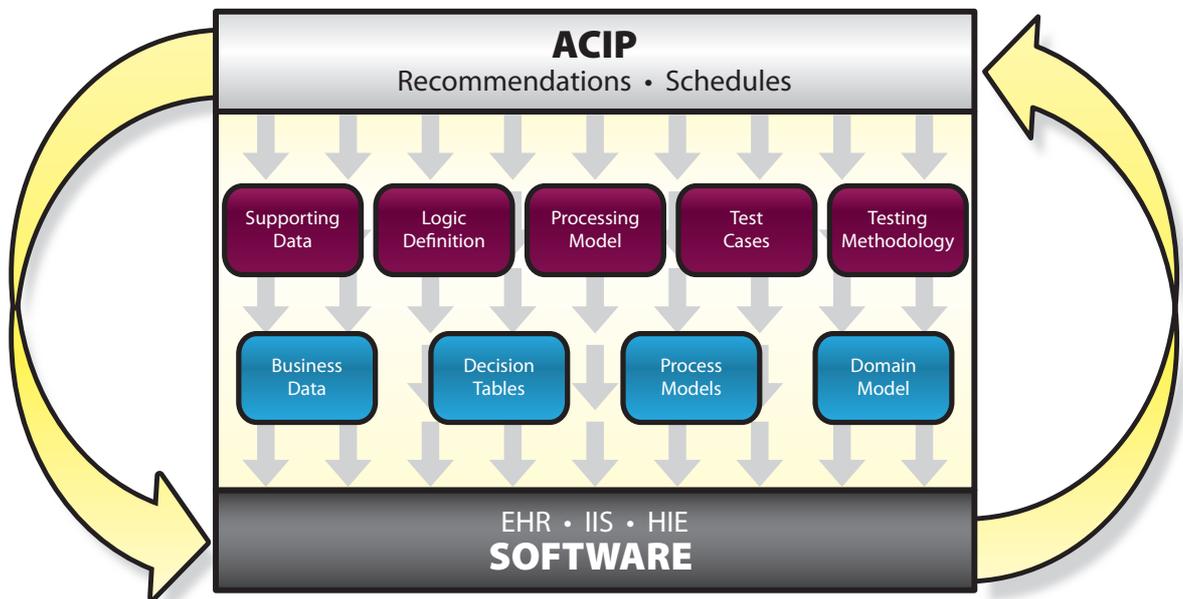
The Logic Specification

The panel developed the **Logic Specification for ACIP Recommendations**, which captures ACIP recommendations in an unambiguous manner and improves both the uniform representation of vaccine decision guidelines as well as the ability to automate vaccine evaluation and forecasting. The Logic Specification provides a single, authoritative, implementation-neutral foundation for development and maintenance of CDS engines.

Logic Specification Design and Documentation Strategy

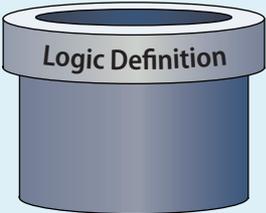
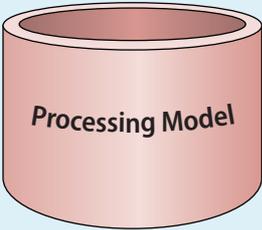
The complexity of the problem and the goals of the project influenced the design strategy. The guiding principles were:

- Separate the complex problem into simpler, more focused parts. The data, algorithm, and framework that pulls the data and algorithm together each became separate components.
- Emphasize “universal” functionality applicable across IIS implementations instead of more detailed, implementation-specific engineering requirements for local needs and technical environments.
- Utilize a variety of mechanisms to document the specification, providing a concise, unambiguous, computable description of the functionality required. These mechanisms include decision tables, business rules, process models, and a domain model.



Logic Specification Components

The Logic Specification consists of the following three components:

Component	Description
 <p>Supporting Data</p>	Describes, by antigen, various factors and their accompanying sets of values to be considered when implementing ACIP recommendations.
 <p>Logic Definition</p>	Describes the functionality required to evaluate and forecast based on a patient's immunization history and the supporting data.
 <p>Processing Model</p>	Describes the structure necessary to pull the details of the logic definition, supporting data and patient-related data together.

Testing the Specification

The panel developed a **Testing Methodology** to validate recommendations delivered by CDS engines. Test cases and expected results were created and can be used to validate or test a CDS algorithm against the Logic Specification.

The Testing Methodology consists of the following two components:

Testing Methodology	Test Cases	Provide a representative set of scenarios and their expected outcomes as dictated by the Logic Specification.
	Testing Document	Details the process used to develop the test cases and how to maintain them.

Target Audience

The target audience for the Logic Specification for ACIP Recommendations includes business and/or technical implementers of immunization CDS engines. These implementers may support any system with an immunization evaluation and forecasting engine, including but not limited to IIS.

The Logic Specification was developed to be as implementation-neutral as possible to support those currently with or without complete evaluation and forecasting engines as they:

- Refine, extend and/or develop their implementation
- Clarify their understanding
- Troubleshoot and/or verify correct implementation

The intended audience of the Testing Methodology is implementers of immunization evaluation and forecasting products and services with a sound understanding of immunization evaluation and forecasting testing. Both business analysts and software developers will find value in the testing components.

Frequently Asked Questions:

How will state and local differences be handled?

State and local differences can be supported within the Logic Specification through modification of the supporting data. The supporting data was separated from the logic definition to simplify the maintenance required when new ACIP recommendations are released. Although the definition of which attributes can be described will be relatively static, as new recommendations are made, changes in at least some of the values are highly likely. If supporting data is ultimately implemented as some form of data store or in a database, changes to the Logic Specification would require minimal, if any, updates to the coded system. Separating the supporting data makes it easier to support local differences, state laws, etc., with minimal impact on the implemented logic or code.

How will I get support?

Users of the CDSi resources will obtain support via email to nipinfo@cdc.gov.

What will happen when ACIP makes recommendation changes?

Each time ACIP updates its recommendations, a team designated to maintain the Logic Specification will update the resource accordingly. Subsequently, communications will be disseminated to the community to make them aware of the changes.

The Logic Specification can be found on the IISB web site at:

<http://www.cdc.gov/vaccines/programs/iis/interop-proj/cds.html>



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