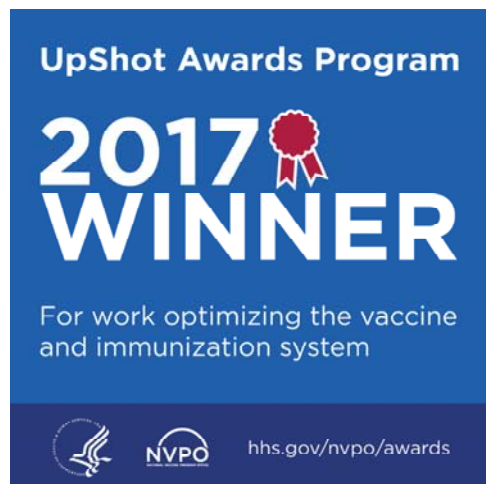# Immunization Calculation Engine (ICE)

The Immunization Calculation Engine (ICE) is a state-of-the-art open-source immunization forecasting software system which has two major components. The **ICE Web Service** evaluates a patient's immunization history and generates the appropriate immunization recommendations for the patient. The **Clinical Decision Support Administration Tool** (abbreviated as the **"CDS Admin Tool"** or as **"CAT"**) is a web-based GUI tool that enables subject matter experts to test ICE rules and configuration without the intervention of software developers.

Any organization may freely adopt ICE due to its open source license and complete lack of dependence on any commercial software. Through its standards-based Web Service interface, ICE easily integrates with third party clinical information systems such as electronic health record systems (EHR-S), Immunization Information Systems (IIS), and Health Information Exchanges (HIEs) - regardless of their software architecture (.NET, Java, or other). Because of ICE's Java-based implementation, it can be deployed in diverse technical environments.

ICE comes pre-configured with the childhood, adolescent, and adult schedules for fourteen vaccine groups, and the implemented rules are based on the recommendations of the Advisory Committee on Immunization Practices (ACIP). However, any organization may configure ICE to suit its own needs and can adapt ICE as new vaccines come to market and as the recommendations of the ACIP change.

- DTP
- H1N1
- Hep A
- Hep B
- Hib
- HPV
- Influenza
- Meningococcal ACWY
- Meningococcal B
- MMR
- Pneumococcal
- Polio
- Rotavirus
- Varicella
- Zoster

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ICE's Web Service architecture scales to support simultaneous real-time processing of many patients submitted by one or more systems. It can also service requests for multiple immunization schedules. For example, a single ICE deployment could enforce one immunization schedule utilized by multiple EHR-S, another immunization schedule used by an IIS, and a third immunization schedule utilized by a school health system.

An executable binary distribution of the ICE Web Service is immediately available for production use, as is a cloud-based instance of ICE that organizations may freely connect to for evaluation and testing.

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The ICE Web Service has been implemented as a clinical module within **OpenCDS** (www.opencds.org), an open-source software framework that provides developers with a set of tools for implementing clinical decision support services. Clinical information systems may utilize ICE by making a SOAP Web Service call to the ICE Web Service, which conforms to the Decision Support Service (DSS) standard that has been specified by HL7 International and the Object Management Group (OMG). The clinical information system sends a patient's data to ICE utilizing the Virtual Medical Record (vMR) format, which is an emerging standard within the HL7 Clinical Decision Support Workgroup. In response, ICE utilizes its immunization rules and the data in the vMR, such as the patient's date of birth, gender, immunization history, and disease indicators, to evaluate and return the validity of each immunization in the patient's history along with one or more evaluation reasons. ICE also returns a recommendation for each vaccine group along with a recommendation reason.
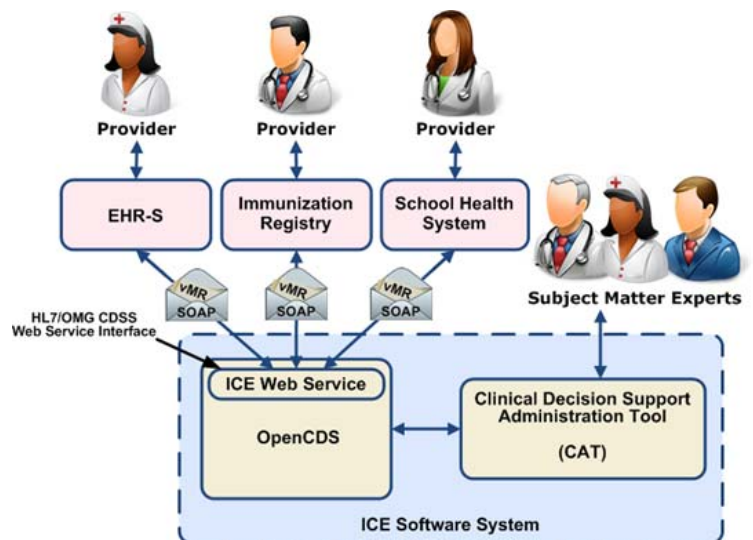

ICE is maintained through an open and collaborative process. **Why choose ICE?**

- Rigorously developed
- Standards-based
- Scalable
- Comprehensive testing tool
- Open source software – no vendor lock-in
- Flexible deployment options

No commercial software or commercial services are required to utilize the ICE software system. However, if your organization would like assistance with ICE, then HLN can offer a variety of customized services to meet your specific needs. HLN's ICE related service offerings include:

- **Technical Support** – HLN can provide technical support to your IT staff on an as-needed basis via web conference, telephone, and email. HLN can also create additional technical documentation, collaborate with your IT staff to integrate ICE with your healthcare systems, or enhance the CAT to meet the custom needs of your organization.
- **User Support** – HLN can create documentation for or provide training to subject matter experts who will be utilizing the CAT.
- **Configuration Services** – HLN can customize or maintain an immunization schedule on behalf of your organization.
- **Hosted ICE Service** – HLN can host an instance of the ICE web service that your clinical information systems can securely connect to over the internet.

Sample ICE Deployment

The ICE software system is being developed and configured by a collaborative partnership of public health and information technology experts from the New York City Department of Health and Mental Hygiene, Citywide Immunization Registry (CIR); HLN Consulting, LLC; the Alabama Department of Public Health (ADPH); and the OpenCDS collaboration which is led by researchers at the University of Utah, Department of Biomedical Informatics. The developers of ICE are seeking additional organizations that are interested in evaluating and utilizing ICE.

For more information about ICE, go to **www.hln.com/ice** or contact **ice@hln.com**.