



# Use of the Immunization Calculation Engine (ICE) for Immunization Forecasting

41st VistA Community Meeting  
September 8, 2023



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# Immunization Calculation Engine (ICE)



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## About ICE

The Immunization Calculation Engine (ICE) open source software supports immunization evaluation and forecasting in alignment with Advisory Committee on Immunization Practices (ACIP) recommendations.



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## Original ICE collaborators

- New York City Citywide Immunization Registry
- HLN Consulting, LLC
- Alabama Dept of Public Health
- OpenCDS Team
  - Software platform and toolkit
  - Open source
  - Standards-based
  - Web Service interface
  - Collaborative project: Dr. Kensaku Kawamoto at University of Utah



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## ICE software and documentation is freely available

- Documentation, executable software, and source code is publicly accessible
- Standard, permissive open-source license (LGPL v3)

ICE Wiki:

<https://cdsframework.atlassian.net/wiki/spaces/ICE/overview>



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## ICE easily integrates with health IT systems

- Designed for integration and use with any system that contains immunization data
- Standards-based architecture and APIs
- Variety of deployment options
- Used in public health, clinical, and research settings



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## ICE supports routine immunizations across the lifespan

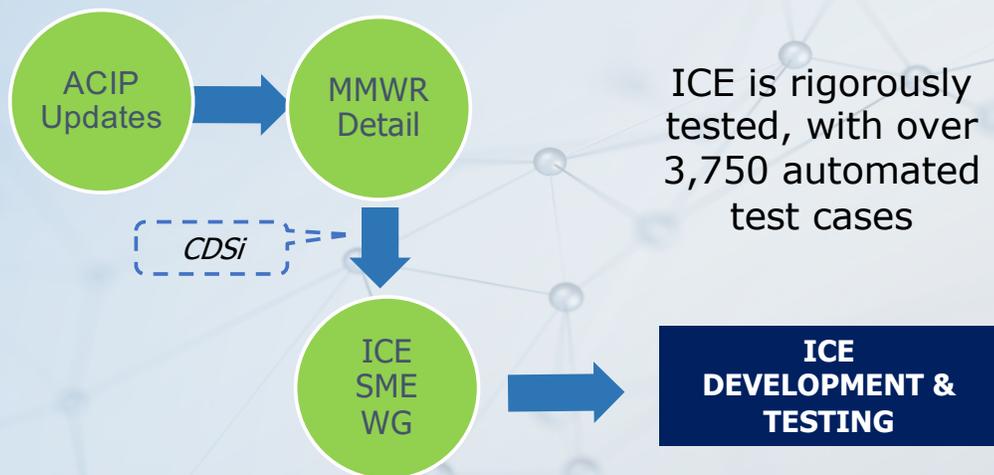
- Addresses routine child, adolescent, and adult immunizations in alignment with ACIP recommendations
- Supports a default immunization schedule with evaluation and forecasting for 17 vaccine groups
  - COVID-19
  - DTP
  - H1N1
  - Hepatitis A
  - Hepatitis B
  - Hib
  - HPV
  - Influenza
  - Meningococcal ACWY
  - Meningococcal B
  - MMR
  - Orthopoxvirus
  - Pneumococcal
  - Polio
  - Rotavirus
  - Varicella
  - Zoster



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## ICE adapts to changing recommendations



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## “ICE Client” Application is a free test tool to try ICE

- Browser-based app: <http://cds.hln.com/iceweb/>
- Simple user interface for creating/submitting sample patient data and seeing ICE response/results
- Uses instance of ICE service hosted by HLN
- Shows vMR-formatted version of sample patient data from user, formatted by client app
- Shows raw vMR-formatted output, returned by hosted ICE instance



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## ICE Client - Patient list

ICE Client v1.0.11

**Patient List**

Name: Bare, Yogli  
DOB: 2009-11-30  
Gender: M

Name: Smith, John  
DOB: 2018-10-15  
Gender: M

+ Add Patient   ↑ Import Patient   ⚙ Settings   ⓘ About   🗨 Help

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# ICE Client App - Edit a patient

ice Patient Editor

NOTE: for dates, use "yyyymmdd" format (e.g. 19301231).

**Demographics**

First Name: John

Last Name: Smith

Gender:  Male  Female  Other

Birth Date: 20181015

Evaluation Date:

**Immunizations & Diseases**

Type	Code	Date	Delete
<input checked="" type="checkbox"/> Disease	08: Hep B, adolescent or pe...	20181015	

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# ICE Client - "ICE" the record

ICE Client v1.0.11

cds.hln.com/iceweb/

**Patient List**

Name: Bare, Yogii  
DOB: 2009-11-30  
Gender: M

Name: Smith, John  
DOB: 2018-10-15  
Gender: M

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## ICE Client - Evaluation date, age at evaluation

**Name:** John Smith  
**DOB:** 2018-10-15  
**Gender:** M  
**Evaluation Date:** 2019-08-19  
**Age @Evaluation:** 0y 10m 4d

Patient Output Grid - Click on the bulleted-list icons for additional details

Vaccine Group	Recommendations	Evaluations
Hep B	Recommendation Date: 2018-11-15 Overdue Date: 2019-02-11 Earliest Date: 2018-11-12 Status: RECOMMENDED Message: DUE_NOW Vaccine Group: Hep B	Date: 2018-10-15 Age: 0y 0m 0d Valid: true Vaccine: Hep B, adolescent or pediatric (08)
DTP	Recommendation Date: 2018-12-15 Overdue Date: 2019-02-11 Earliest Date: 2018-11-26 Status: RECOMMENDED Message: DUE_NOW Vaccine: DTaP NOS (107)	

## ICE Client - Evaluation

**Name:** John Smith  
**DOB:** 2018-10-15  
**Gender:** M  
**Evaluation Date:** 2019-08-19  
**Age @Evaluation:** 0y 10m 4d

Patient Output Grid - Click on the bulleted-list icons for additional details

Vaccine Group	Recommendations	Evaluations
Hep B	Recommendation Date: 2018-11-15 Overdue Date: 2019-02-11 Earliest Date: 2018-11-12 Status: RECOMMENDED Message: DUE_NOW Vaccine Group: Hep B	Date: 2018-10-15 Age: 0y 0m 0d Valid: true Vaccine: Hep B, adolescent or pediatric (08)
DTP	Recommendation Date: 2018-12-15 Overdue Date: 2019-02-11 Earliest Date: 2018-11-26 Status: RECOMMENDED Message: DUE_NOW Vaccine: DTaP NOS (107)	

# ICE Client - Forecast

**Name:** John Smith  
**DOB:** 2018-10-15  
**Gender:** M  
**Evaluation Date:** 2019-08-19  
**Age @Evaluation:** 0y 10m 4d

Patient Output Grid - Click on the bulleted-list icons for additional details

Vaccine Group	Recommendations	Evaluations
Hep B	Recommendation Date: 2018-11-15 Overdue Date: 2019-02-11 Earliest Date: 2018-11-12 Status: RECOMMENDED Message: DUE_NOW Vaccine Group: Hep B	Date: 2018-10-15 Age: 0y 0m 0d Valid: true Vaccine: Hep B, adolescent or pediatric (08)
DTP	Recommendation Date: 2018-12-15 Overdue Date: 2019-02-11 Earliest Date: 2018-11-26 Status: RECOMMENDED Message: DUE_NOW Vaccine: DTaP NOS (107)	



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# ICE Client - Debug mode

ICE Response Data: 

```
{
  "100": {
    "groupName": "Hep B",
    "evaluations": [
      {
        "id": "c311601b-50fd-5e61-cfad-d6eca5ffe3",
        "substanceCode": "08",
        "componentSubstanceCode": "08",
        "administrationTime": "20181015",
        "doseNu
```

Input VMR: 

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ns3:cdsInput
xmlns:ns2="org.opencds.vmr.v1_0.schema.vmr"
xmlns:ns3="org.opencds.vmr.v1_0.schema.cdsinput">
```

Output VMR: 

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?><ns2:cdsOutput
xmlns:ns2="org.opencds.vmr.v1_0.schema.cdsoutput"
xmlns:ns3="org.opencds.vmr.v1_0.schema.vmr"
```

SOAP Request: 

```
<?xml version="1.0" encoding="utf-8"?>
<S:Envelope
xmlns:S="http://www.w3.org/2003/05/soap-envelope">
```

SOAP Response: 

```
<soap:Envelope
xmlns:soap="http://www.w3.org/2003/05/soap"
```



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# RI KIDSNET


Welcome to KIDSNET and RICAIR


**Navigation**

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- [SEAL RI Dental Sealant Program](#)

Search KIDSNET / RICAIR ID:  [Search](#)

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**Patient Info**

First Name: **MICKEY** Middle: **A** Last: **MOUSE** KIDSNET / RICAIR ID: **7596298**

Date of Birth: **01/01/2019** Age: **15m 10d** Gender: **MALE**

KIDSNET Status: **ACTIVE** PCP: **CAPITOL HILL HEALTH CENTER-PCHC**

---

Parent/Guardian: **MINNIE A MOUSE** Date of Birth: **01/01/1990**

**School Requirements:** K: **X** 7th: **X** 8th: **X** 9th: **X** 12th: **X**

[Change Immunization History](#)

VALID DOSES					NEXT DUE
Influenza 3 valid doses	10/15/2019 FLU QUAD 9m 14d	11/01/2019 FLU QUAD 10m 0d <b>[1]</b>			<b>Due Now</b> (On or after 11/29/2019) Dose 2
Hepatitis B 3 valid doses	01/01/2019 HepB ped/adol 0m 0d	03/01/2019 DTaP-HepB-IPV 2m 0d	05/01/2019 DTaP-HepB-IPV 4m 0d <b>[2]</b>	07/01/2019 DTaP-HepB-IPV 6m 0d	<b>End of Series</b>
DTaP/DT/dap/Td 3 valid doses	03/01/2019 DTaP-HepB-IPV 2m 0d	05/01/2019 DTaP-HepB-IPV 4m 0d	07/01/2019 DTaP-HepB-IPV 6m 0d		<b>Due Now</b> (04/01/2020 - 08/28/2020) Dose 4
Pneumo 0 valid doses					<b>Past Due</b>
Polio 3 valid doses	03/01/2019 DTaP-HepB-IPV 2m 0d	05/01/2019 DTaP-HepB-IPV 4m 0d	07/01/2019 DTaP-HepB-IPV 6m 0d		<b>Due in the Future</b> (01/01/2023 - 01/28/2025) Dose 4
Hib 0 valid doses					<b>Due Now</b> (04/01/2020 - 05/28/2020) Dose 1



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# RI KIDSNET

MMR 0 valid doses					<b>Due Now</b> (01/01/2020 - 05/28/2020) Dose 1
Varicella 0 valid doses <b>IMMUNE</b> Varicella					
Zoster 0 valid doses					
Hepatitis A 1 valid doses	01/01/2020 HepA ped/adol 12m 0d	04/01/2020 HepA ped/adol 15m 0d <b>[1]</b>			
MenACWY 0 valid doses					
MenB 0 valid doses					
HPV 0 valid doses					<b>Due in the Future</b> (01/01/2030 - 01/28/2032) Dose 1

**CVX:** 83 (HepA ped/adol)

**Mfg:**

**Lot #:**

**Reporting Provider ID:** 33

**Reporting Provider:** CAPITOL HILL HEALTH CENTER-PCHC

**Source:** ADMINISTERING PROVIDER

**Date Created:** 04/11/2020

**Dose #:** 2

**Footnote:** Minimum Age Not Satisfied

**Minimum Acceptable Dose Administration Date:** 07/01/2020

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## Known ICE users\*

- Physician's Computer Company (piloting, 2023)
- Docket PHR (2022)
- Office Practicum (2022)
- WebChart (2020)
- empower systems (2020)
- athenaPractice EHR (2020)
- Indian Health Service – RPMS EHR (2020)
- AZOVA Vaxigo Clinical System (2020)
- GE Centricity/Health 1 Technologies EHR (2018)
- New York-Presbyterian Hospital/Columbia University Medical Center (2017)
- CareDox PHR (2014)
- eClinicalWorks EHR (2013)
- CDC WIR IIS Software Replacement (when released – 2022)
- Massachusetts Department of Public Health – IIS (2021)
- Virginia Department of Health – Web Vision Public Health EHR (2020)
- New York City Department of Health and Mental Hygiene – Citywide Immunization Registry (2020, in phases)
- Vermont Department of Health – IIS (2020)
- Rhode Island Department of Health – IIS (2020)
- Michigan Department of Health and Human Services – IIS (2018, in phases)
- New Jersey Department of Health – IIS (2018)



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\*To the best of our knowledge

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## ICE resources

- HLN ICE Webpage [www.hln.com/ice](http://www.hln.com/ice)
- ICE Wiki <https://cdfsframework.atlassian.net/wiki/spaces/ICE/overview>
  - Subscribe to ICE Announcements <https://docs.google.com/forms/d/e/1FAIpQLSeeOLj7arRnJU14vBtJZsCDKOcP-76vIL0PP-KduGalxJdWO/viewform>
  - ICE Immunization Schedule [cdfsframework.atlassian.net/wiki/spaces/ICE/pages/14352468/Default+Immunization+Schedule](https://cdfsframework.atlassian.net/wiki/spaces/ICE/pages/14352468/Default+Immunization+Schedule)
  - Executable software distribution and source code [cdfsframework.atlassian.net/wiki/spaces/ICE/pages/18972704/Downloads](https://cdfsframework.atlassian.net/wiki/spaces/ICE/pages/18972704/Downloads)
- Try ICE with the ICE Client App <https://cdfsframework.atlassian.net/wiki/spaces/ICE/pages/27820034/Try+ICE+by+Using+the+ICE+Client+App>
- OpenHealthNews article [www.openhealthnews.com/articles/2019/anatomy-public-health-open-source-project-hlms-immunization-calculation-engine-ice](http://www.openhealthnews.com/articles/2019/anatomy-public-health-open-source-project-hlms-immunization-calculation-engine-ice)



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# Indian Health Service ICE Forecaster

CAPT SURYAM PALANKI

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DIVISION OF INFORMATION TECHNOLOGY

PHARMACY INFORMATICS CONSULTANT

SEPTEMBER 8, 2023

# Immunization Component

The screenshot displays the 'Immunization Record' interface for a patient named HEP & NOS. It includes a 'Forecast' section, a 'Past Due' section, and a table of 'Immunization History'. The table columns include Registry, Visit Date, Admin Date, Vaccine, Ordered By, Administered By, Age@Visit, Location, Reaction, Inj Site, and Lot. A 'Contraindications' table is also visible, listing sources like ITN1, HEP A PED, and CDT Jan with their respective reactions and dates.

Registry	Visit Date	Admin Date	Vaccine	Ordered By	Administered By	Age@Visit	Location	Reaction	Inj Site	Lot
RPMS ONLY	08/01/2022	08/01/2022	HEP B PED (COM-IV)			57 mths	Walgreens			
RPMS ONLY	08/01/2022	08/01/2022	PEZIVAHB (COM-IV)			57 mths	Walgreens			
RPMS ONLY	01-12-2021	01-12-2021	COV Mod		FLOOD WILLIAM	38 mths	2017 DEMO CLINIC TEHRA		Right Deltoid W	Z3459M00
RPMS ONLY	02-10-2023	02-10-2023	COV ModBP4			57 mths	Tesque			
RPMS ONLY	03/06/2023	03/06/2023	COV ModBP4			57 mths	Elm Yuhansen Yungwanh Ctr			
RPMS ONLY	08/01/2022	08/01/2022	COV ModTet			57 mths	Walgreens			
RPMS ONLY	01-12-2021	01-12-2021	COV P6		FLOOD WILLIAM	38 mths	2017 DEMO CLINIC TEHRA		Left Thigh W	07039P2
RPMS ONLY	06/27/2022	10/05/2022	COV P6Tet		STRUBLE FAY	55 mths	2017 DEMO CLINIC TEHRA		Left Thigh W	
RPMS ONLY	08/01/2022	08/01/2022	DTaP			57 mths	Walgreens			
RPMS ONLY	02/15/2023	02/15/2023	DTaP			57 mths	Tucson Indian Center			
RPMS-HC	07/26/2018	07/26/2018	DTaP			8 mths	Clarence Hospital			

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# ICE Forecasting in EHR/RPMS

```

Patient: TEST,ORINA DOB: 37-Jul-1963 (60 yrs)
HLN ICE Forecaster v5.37.2 For: 09/08/2023 (run: 09/08/2023 @ 07:43)
--- IMMUNIZATION EVALUATION ---
Date CVM Vaccine (Combo) Status Reason
02/23/2023 03 HBB (HBBV) VALID
07/17/2023 03 HBB (HBBV) VALID
07/27/2023 03 HBB (HBBV) VALID
07/28/2023 03 HBB (HBBV) VALID
07/28/2023 03 HBB (HBBV) ACCEPTED The vaccine administered
is an extra dose.
07/27/2023 21 VARICELLA (MMV) VALID
07/17/2023 21 VARICELLA (MMV) VALID
07/08/2023 21 VARICELLA (MMV) ACCEPTED The vaccine administered
is an extra dose.
07/17/2023 097 FLU-HE046 VALID
07/09/2023 097 FLU-HE046 VALID
08/19/2023 213 COV,Jan VALID
08/19/2023 213 COV,Jan VALID
08/19/2023 208 UNLLP,PMR VALID
08/19/2023 208 UNLLP,PMR VALID
--- FORECAST ---
Vaccine Status Earliest Recommended Overdue
HEP B,MMV Due Home 08/07/2023 08/07/2023 NO DATE
FLU,MMV Due Home 07/08/2023 07/08/2023 NO DATE
DTaP,Shgrn Due Home 06/15/2023 06/15/2023 NO DATE
PHE046,MMV Due in Future 07/07/2027 07/07/2023 08/01/2023
COMPLETE:
Vaccine Status
VARICELLA Complete
COV,MMV Complete
UNLLP,PMR Complete
HLN HLN:
Vaccine Status
MMV -----
Supplemental Text:
The Pneumococcal evaluations and recommendations in ICE primarily target the
routine series. Results ages 18-64 with underlying medical conditions or
other risk factors who have not previously received PCV13 or whose previous
vaccination history is unknown should receive 1 dose of PCV (either PCV09 or
PCV13). When PCV13 is used, it should be followed by a dose of PPSV23 at the
appropriate interval(s). Patients who previously received a PCV13 should
receive PPSV23 as recommended for them before the introduction of PCV13 and
PCV09. Based on age or risk factors, refer to ACP for additional
information. The vaccine administered should be a single dose of a Pfizer
COVID-19 vaccine.
    
```

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# ICE Supplemental Text

```

HLN ICE Forecaster v1.37.2 for:
-- IMM HISTORY EVALUATION -----
  Date      CVX   Vaccine (combo)      Status - Reason
-----
-- FORECAST -----

HIGH RISK:
| Vaccine   Status
| -----
| None

Supplemental Text:
-----
The Pneumococcal evaluations and recommendations in ICE primarily target the routine series. Adults ages 19-64 with underlying medical conditions or other risk factors who have not previously received PCV or whose previous vaccination history is unknown should receive 1 dose of PCV (either PCV20 or PCV15). When PCV15 is used, it should be followed by a dose of PPSV23 at the appropriate interval(s). Patients who previously received a PCV13 should receive PPSV23 as recommended for them before the introduction of PCV15 and PCV20, based on age or risk factors. Refer to ACIP for additional information. The vaccine administered should be a single dose of a Pfizer COVID-19 vaccine.
    
```

# ICE Supplemental Text

```

HLN ICE Forecaster v1.37.2 for:
-- IMM HISTORY EVALUATION -----
  Date      CVX   Vaccine (combo)      Status - Reason
-----
01/01/2022  218   COV,PfrPed           VALID
01/22/2022  218   COV,PfrPed           VALID
05/22/2022  301   COV,PfrBBP           VALID
Supplemental Text:
-----
The timing of the administration of this shot does not follow the guidelines regarding the minimum interval of 5 months required for the 1st Booster Dose.
    
```

## Questions?

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