



Transitioning and Expanding Rhode Island's Childhood Algorithm to ICE

**AIRA National Meeting
Indianapolis, Indiana
Session 5D – CDSi
August 14, 2019**

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Agenda



- **KIDSNET Background**
 - Transition to a Lifelong Immunization Registry
 - Immunization Algorithm
- **ICE Background**
 - Overview & Objectives
 - Governance & Advisory Structure
- **Adopting ICE in KIDSNET**
 - Analysis of differences
 - Web display
 - Reports & HL7
 - Testing
- **Conclusions**

KIDSNET Background



- Integrated child health information system with IIS
- Operating since 1997
- Immunization data limited to <19 year olds
- Other public health collected for young children

Transitioning to a Lifelong Registry



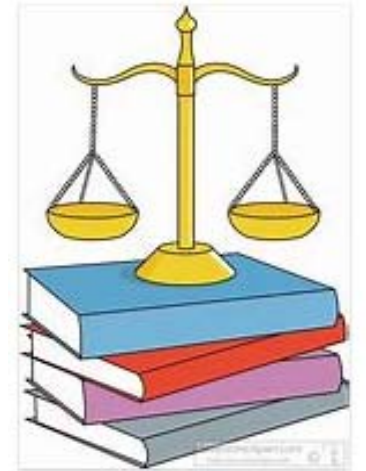
- Authority to collect the data
- Resources: Funding and Staffing
- Database revisions to accommodate adults
 - Demographics
 - Expanded immunization algorithm



Adult Immunizations- Authority



- Previously lacked authorizing legislation
- Legislation proposed in 2017-2018 session
- Legislation passed in 2018-2019 session



Funding and Resources



- **Funding:**
 - Medicaid 90/10
 - State Restricted Receipt
- **Staffing:** Pending
 - Onboarding
 - Data Management
 - Training/Provider relations



Need for a New Algorithm

- **Algorithm History**
- **Known limitations of KIDSNET algorithm**
 - Data, evaluations and recommendations limited to <19 year olds
 - Did not include all vaccines
 - Some limited areas of non-compliance with CDSi
 - Expensive to develop and maintain
- **Advantages of transitioning to ICE**
 - Already developed for all ages
 - Known compliance with CDSi
 - Regular new releases not dependent on internal staffing limitations

Immunization Calculation Engine (ICE) Overview



- **Open source immunization forecaster:** default set of ACIP rules
- **Technology stack:** OpenCDS, vMR, Drools, Java EE, web services
- **Original collaborators:**
 - New York City Citywide Immunization Registry
 - HLN Consulting, LLC
 - Alabama Department of Public Health
 - OpenCDS Team
- **Used by:** IIS, EHRs, physician practices; and for reporting/research
- Freely available at **cdfsframework.org**

ICE Objectives	Achievement
Supports routinely administered vaccine groups	<ul style="list-style-type: none">• Supports 16 vaccine groups – all ages
Promotes clinical best practices	<ul style="list-style-type: none">• Follows ACIP recommendations• Informed by CDC's CDSi project
Adapts to changing requirements	<ul style="list-style-type: none">• Tools that allow self-administration• Automated testing tool w/2,700+ test cases• Engineered for high performance and scalability
Easily integrates with IIS and other health systems	<ul style="list-style-type: none">• Standards-based architecture and APIs• Variety of deployment options
Software and knowledge base freely available	<ul style="list-style-type: none">• Standard, permissive open-source license (LGPL v3)• Downloadable from public website

ICE Governance Principles



- **Availability:** Changes to the Open Source software available to all
- **Consensus-Based:** Base rules maintained and be freely available to all users.
- **Protecting Knowledge Generation:** Alternate rule sets may be freely available from the organizations that create them
- **Leveraging Resources:** Activities should be leveraged across participants
- **Encouraging Innovation:** “Enhanced features” may be created that comply with the Open Source license but which might not be freely available

ICE Advisory Structure



Review Board

- **Role:** Advise on ICE product direction; provide feedback on ICE updates based on interpretations from SME WG
- **Activities:** Quarterly meetings; identify ICE enhancements or functionality needs of the clinical community

Subject Matter Expert Workgroup

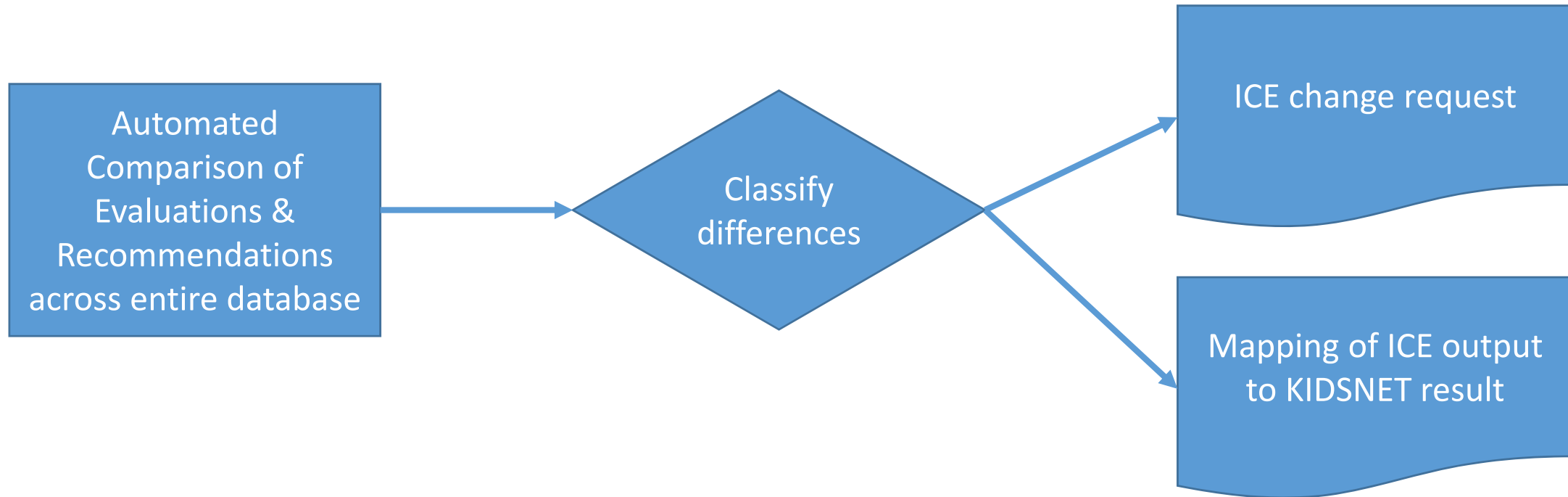
- **Role:** Reach consensus on ICE rule changes based on ACIP recommendation updates
- **Activities:** Meet monthly or as needed; identify ICE enhancements or functionality needed; seek ACIP rule clarifications

Preparing for ICE Implementation



- Analysis of ICE vs existing Algorithm
- Map KIDSNET footnotes to ICE
- Identify Web display changes needed
- Evaluate Report and HL7 changes
- Testing

Analysis: ICE vs. existing algorithm



Common algorithm differences - per 1,000



- Duplicate vaccine/same day explicitly handled in ICE (365)
- Pneumo & Hib: “Conditional High Risk” ICE forecast (105)
- KINRIX at 4-6y – special footnote in old algorithm (70)
- Extra dose of Pediarix – special footnote in old algorithm (33)
- Extra dose of Pneumo – ICE identifies as extra dose (30)
- Rotavirus: “Shot not medically appropriate but accepted” in old algorithm, valid in ICE (26)
- Flu season completed – special footnote in old algorithm (23)

ICE to KIDSNET Mappings

	Evaluation	Recommendation
Old KIDSNET Algorithm	<p>38 evaluation “footnotes” ranging from “OK” and “Minimum Age not satisfied” (common) to “Please contact KIDSNET to report which Meningococcal B vaccine was administered” and “Zoster not normally given at this age, however it counts toward completing the Varicella series.” (uncommon)</p>	<p>Complete for Season, End of Series Reached, Due in the Future / Due Now / Past Due, Recommended for High Risk Children, Maximum Age Reached, No evaluation or recommendations</p>
ICE	<p>Observation: VALID, INVALID, ACCEPTED, NOT_EVALUATED, IGNORE</p> <p>Interpretation: BELOW_MINIMUM_AGE_SERIES, BELOW_MINIMUM_AGE_VACCINE, DUPLICATE_SAME_DAY, EXTRA_DOSE, TOO_EARLY_LIVE_VIRUS, BELOW_MINIMUM_INTERVAL, ...</p>	<p>Observation: NOT_RECOMMENDED, RECOMMENDED, FUTURE_RECOMMENDED, CONDITIONAL, RECOMMENDATION_NOT_AVAILABLE</p> <p>Interpretation: COMPLETE, DUE_NOW, DUE_IN_FUTURE, HIGH_RISK, COMPLETE_HIGH_RISK, TOO_OLD_HIGH_RISK, TOO_OLD, TOO_OLD_TO_INITIATE, ...</p>



Mapping Spreadsheets

Evaluations:

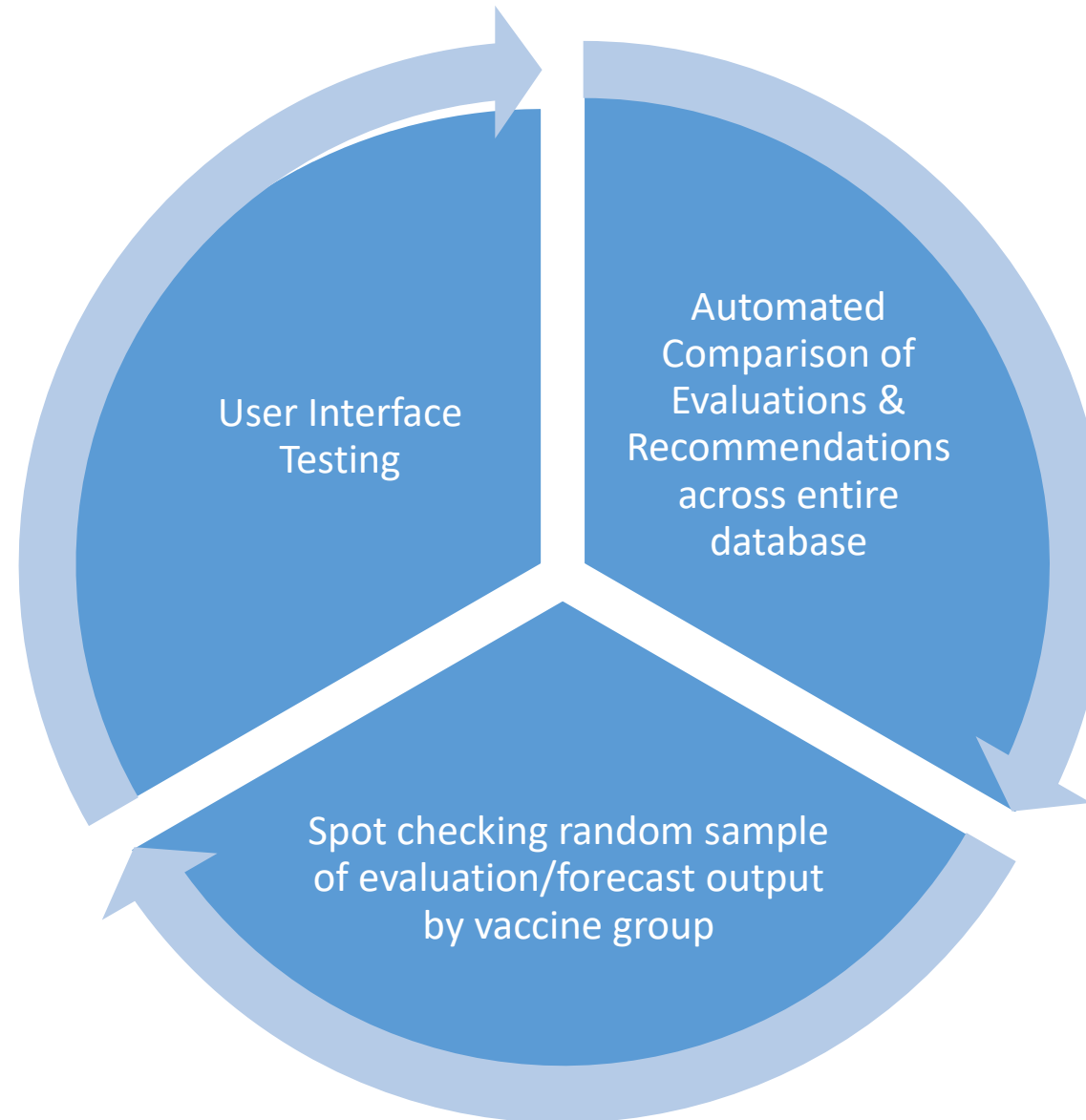
A	B	C	D	F
-> Mappings are executed from top to bottom -->	ICE_OBSERVATION_CODE	ICE_INTERPRETATION_CODE	VACCINE_GROUP	KIDSNET_FOOTNOTE_TEXT
	VALID	*	Any	OK(no footnote)
	INVALID	BELOW_MINIMUM_AGE_SERIES	Any	Minimum Age Not Satisfied
	INVALID	BELOW_MINIMUM_AGE_VACCINE	Any	Minimum Age Not Satisfied
	INVALID	DUPLICATE_SAME_DAY	Any	Duplicate dose
	ACCEPTED	EXTRA_DOSE	Influenza	Dose(s) for season previously completed
	ACCEPTED	EXTRA_DOSE	Any	Excess vaccine, this dose not recommended
	INVALID	TOO_EARLY_LIVE_VIRUS	Any	Live Virus Vaccine Separation not Satisfied
	INVALID	BELOW_MINIMUM_INTERVAL	Any	Minimum Interval Not Satisfied
	ACCEPTED	BELOW_REC_AGE_SERIES	Mening	Meningococcal before 10y does not count toward
	ACCEPTED	BELOW_REC_AGE_SERIES	Any	Used for specific medical indications only.
	ACCEPTED	BELOW_MINIMUM_AGE_FINAL_DOSE	Any	Minimum Age Not Satisfied
	ACCEPTED	ABOVE_REC_AGE_SERIES	Any	Minimum age for this vaccine is 19, however do
	INVALID	INSUFFICIENT_ANTIGEN	Td/Tdap/D	
	INVALID	INSUFFICIENT_ANTIGEN	Any	
	ACCEPTED	VACCINE_NOT_ALLOWED	Pneumo	
	ACCEPTED	VACCINE_NOT_ALLOWED	Any	
	ACCEPTED	VACCINE_NOT_PART_OF_THIS_SERIES	Pneumo	
	ACCEPTED	VACCINE_NOT_PART_OF_THIS_SERIES	Any	
	INVALID	MISSING_ANTIGEN	Td/Tdap/D	
	INVALID	MISSING_ANTIGEN	Polio	
	INVALID	MISSING_ANTIGEN	Any	
	INVALID	BOOSTER_ONLY	Td/Tdap/D	
	NOT_EVALUATED	VACCINE NOT SUPPORTED	Mening B	
	NOT_EVALUATED	*	Any	
IGNORE	*	Any		
INVALID	*	Any		
ACCEPTED	*	Any		

Recommendations:

A	B	C	D	F
-> Mappings executed from top to bottom -->	ICE_OBSERVATION_CODE	ICE_INTERPRETATION_CODE	VACCINE_GROUP	KIDSNET_RECOMMENDATION_TEXT
	NOT_RECOMMENDED	COMPLETE	Influenza	Complete for Season
	NOT_RECOMMENDED	COMPLETE	Any	End of Series Reached
	RECOMMENDED	DUE_NOW	Any	Due in the Future / Due Now / Past D
	FUTURE_RECOMMENDED	DUE_IN_FUTURE	Any	Due in the Future / Due Now / Past D
	CONDITIONAL	HIGH_RISK	Mening B	Recommended for High Risk Children
	CONDITIONAL	HIGH_RISK	Any	Maximum Age Reached
	CONDITIONAL	COMPLETE_HIGH_RISK	Any	End of Series Reached
	NOT_RECOMMENDED	COMPLETE_HIGH_RISK	Any	End of Series Reached
	NOT_RECOMMENDED	TOO_OLD_HIGH_RISK	Any	Maximum Age Reached
	NOT_RECOMMENDED	TOO_OLD	Any	Maximum Age Reached
	NOT_RECOMMENDED	TOO_OLD_TO_INITIATE	Any	Maximum Age Reached
	NOT_RECOMMENDED	BELOW_MINIMUM_AGE_HIGH_RISK_SERIES	Any	Recommended for High Risk Children
	CONDITIONAL	CLINICAL_PATIENT_DISCRETION	Any	Recommended for High Risk Children
	NOT_RECOMMENDED	VAC_GROUP_NO_LONGER_REC	Any	No evaluation or recommendations
	RECOMMENDATION_NOT_AVAILABLE	*	Any	No evaluation or recommendations
	NOT_RECOMMENDED	*	Any	No evaluation or recommendations
	RECOMMENDED	*	Any	Due in the Future / Due Now / Past D
	FUTURE_RECOMMENDED	*	Any	Due in the Future / Due Now / Past D
	CONDITIONAL	*	Any	Recommended for High Risk Children

Pre-Adoption Testing

- Web Display
- Reports
- Queries



Web-based Display Changes



[printer-friendly version](#)

Search	
Enter KIDSNET ID: <input type="text"/>	LookUp

Child Information -07/16/2019	
First Name: VIOLET Middle: I Last: ARAGORN KIDSNET ID: 8055092	Date Of Birth: 04/21/2017 Age: 2y 2m Gender: MALE
KIDSNET Status: ACTIVE PCP: WOONSOCKET, THUNDERMIST HEALTH CENTER OF	Parent/Guardian: PARENT LAST Date of birth: 01/01/1970
School Requirements: K: X 7th: X 8th: X 9th: X 12th: X (as of 8/1/2017)	

[Change Immunization History](#)

Valid Doses	1	2	3	4	5	NEXT DUE
Hepatitis B 3 valid doses	04/22/2017 HepB ped/adol 0m 1d	06/27/2017 DTaP-HepB-IPV 2m 6d	09/13/2017 DTaP-HepB-IPV 4m 23d [1]	11/06/2017 DTaP-HepB-IPV 6m 16d		End of Series Reached
DTaP 4 valid doses	06/27/2017 DTaP-HepB-IPV 2m 6d	09/13/2017 DTaP-HepB-IPV 4m 23d	11/06/2017 DTaP-HepB-IPV 6m 16d	07/17/2018 DTaP 14m 26d		Due Future 04/21/2021 - 04/21/2024 Dose 5
Pneumo 4 valid doses	06/27/2017 Pevnar 13 2m 6d	09/13/2017 Pevnar 13 4m 23d	11/06/2017 Pevnar 13 6m 16d	07/17/2018 Pevnar 13 14m 26d		Childhood Series Complete
Polio 3 valid doses	06/27/2017 DTaP-HepB-IPV 2m 6d	09/13/2017 DTaP-HepB-IPV 4m 23d	11/06/2017 DTaP-HepB-IPV 6m 16d			Due Future 04/21/2021 - 04/21/2024 Dose 4
Hib 3 valid doses	06/27/2017 Pedvax HIB 2m 6d	09/13/2017 Pedvax HIB 4m 23d	07/17/2018 Pedvax HIB 14m 26d			End of Series Reached
Rotavirus 2 valid doses	06/27/2017 Rotarix 2m 6d	09/13/2017 Rotarix 4m 23d				End of Series Reached
MMR 1 valid dose	07/17/2018 MMR 14m 26d					Due Future 04/21/2021 - 04/21/2024
Varicella 0 valid doses						Due Future 04/21/2021 - 04/21/2024 Dose 2

Search Patient ID: <input type="text"/>	Search	Press F11 to exit full screen
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Patient Info	
First Name: VIOLET Middle: I Last: ARAGORN KIDSNET / RICAIR ID: 7582413	Date of Birth: 04/21/2017 Age: 2y 2m Gender: FEMALE
KIDSNET Status: ACTIVE PCP: WOONSOCKET, THUNDERMIST HEALTH CENTER OF	Parent/Guardian: FIRST A LAST Date of Birth: 01/01/1970
School Requirements: K: X 7th: X 8th: X 9th: X 12th: X	

[Change Immunization History](#)

VALID DOSES					NEXT DUE
Influenza					Due Now (On or after 07/01/2019)
Hepatitis B 3 valid doses	04/22/2017 HepB ped/adol 0m 1d	06/27/2017 DTaP-HepB-IPV 2m 6d	09/13/2017 DTaP-HepB-IPV 4m 23d [1]	11/06/2017 DTaP-HepB-IPV 6m 16d	End of Series
Td/Tdap/DT/D TaP 4 valid doses	06/27/2017 DTaP-HepB-IPV 2m 6d	09/13/2017 DTaP-HepB-IPV 4m 23d	11/06/2017 DTaP-HepB-IPV 6m 16d	07/17/2018 DTaP 14m 26d	Due in the Future (04/21/2021 - 04/20/2024) Dose 5
Pneumo 4 valid doses	06/27/2017 Pevnar 13 2m 6d	09/13/2017 Pevnar 13 4m 23d	11/06/2017 Pevnar 13 6m 16d	07/17/2018 Pevnar 13 14m 26d	End of Series
Polio 3 valid doses	06/27/2017 DTaP-HepB-IPV 2m 6d	09/13/2017 DTaP-HepB-IPV 4m 23d	11/06/2017 DTaP-HepB-IPV 6m 16d		Due in the Future (04/21/2021 - 05/18/2024) Dose 4
Hib 3 valid doses	06/27/2017 Pedvax HIB 2m 6d	09/13/2017 Pedvax HIB 4m 23d	07/17/2018 Pedvax HIB 14m 26d		End of Series
Rotavirus 2 valid doses	06/27/2017 Rotarix 2m 6d	09/13/2017 Rotarix 4m 23d			End of Series
MMR 1 valid doses	07/17/2018 MMR 14m 26d				Due in the Future (04/21/2021 - 05/18/2024) Dose 2
Varicella 1 valid doses	07/17/2018 Varivax 14m 26d				Due in the Future (04/21/2021 - 05/18/2024) Dose 2
Shingles 0 valid doses					Due in the Future (On or after 04/21/2067) Dose 1

ICE Impact on KIDSNET Reports and HL7

- Flu Season
- Flu Forecast for next season

Flu



- Custom workarounds in old algorithm for certain vaccines
- Flu Season/Forecast

AFIX/IQIP



- Tdap rules

Schools



Conclusions

Considerations/Challenges for adopting a new algorithm

- Identifying current system impacts
 - Differences from existing algorithm
 - Impact on web display, reports and Query/Response
- Evaluate cost to adopt and maintain

Benefits of ICE

- Greater consistency with CDSi covering all vaccines
- Joint development on algorithm changes
- Timeliness of implementing new recommendations
- Reduction in cost and time to implement changes



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