



Forecasting

National Immunization
Forecast Tester



**Texas Children's
Hospital®**

Immunization Forecast Tester

Nathan Bunker
Software Developer
Texas Children's
Hospital

William G. Adams, MD
Professor of Pediatrics
Boston University
School of
Medicine/Boston
Medical Center



Background

Texas Children's Hospital (TCH)

- 2009
Forecaster developed
- 2012
Forecast testing
system online

Massachusetts Immunization Information System (MIIS)

- 2007
Immunization Forecaster
Module (IFM) deployed
as independent web-
service



Vision for Forecasting

- Accurate – based on latest recommendations
- Consistent – results match other system results
- Ubiquitous – available with every shot history



Current Barriers

- Forecaster Testing
 - Forecasters may not directly support testing
 - Organization may not have the capacity to test
- Non-standard Integration
 - Forecaster integrated directly into IIS or EHR
 - Separate system with proprietary access method



Proposed Solution

- Centralized location for testing forecasters
- System that can store and organize:
 - Test cases from many different sources
 - Expert opinions on the correct results for test cases
 - Actual results from forecasters
- System that can:
 - Connect to multiple forecast systems
 - Compare expert opinions and actual results

How Solution Will Realize Vision

- Accurate – based on latest recommendations
 - Experts come to consensus on correct results
 - Real forecasters can be both tested and used as known reference forecasters
- Consistent – results match other system results
 - Results from working forecasters can be compared for differences

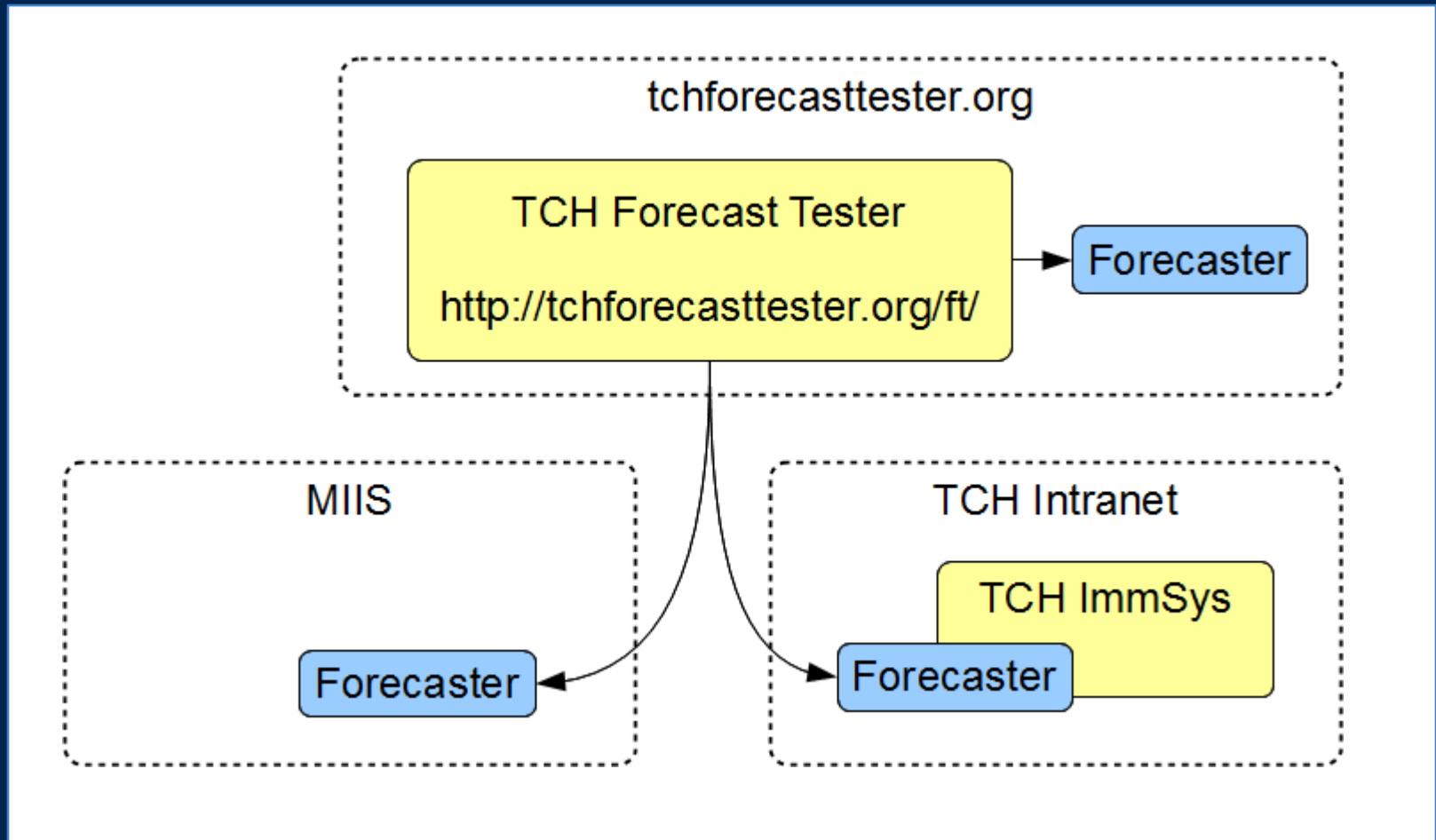


How Solution Will Realize Vision

- Ubiquitous – available with every shot history
 - Integration with national system would encourage the adoption of a national web service standard



Current System



Current Status

- Number of Test Cases
 - TCH: 880
 - MIIS: 840
- Forecasting for all 840 MIIS messages:
 - TCH with no network penalty: 30 seconds
 - TCH with network penalty: 1 minute 16 seconds
 - MIIS with network penalty: 1 minute 22 seconds

Future Work

- Compare results between TCH and MIIS
- Collect more test cases
- Connect to other forecast engines
- Recruit experts to review and give opinions

System Demonstration

- Test cases are purposefully designed to over represent edge cases or unusual situations
- The forecast tester is very strict and focuses on exact dates and dose number
- Edge cases contain many issues that have had various interpretations over the last few years



System Demonstration

- This system often finds many differences between two forecasting systems
- It is amazing is how often two different systems do actually agree exactly



System Organization

- **Expert** – a forecast tester user who can give opinions on correct forecast results
- **Task Group** – a set of experts that work together to create sets of tests
- **Test Panel** – a collection of test cases



System Organization

- **Test Case** – a single scenario with expected answers
- **Software** – a forecaster that can evaluate a test case and give an answer



Test Case Information

- Date of Birth, Sex
- Evaluation Date
- Vaccination History
 - CVX
 - MVX (optional)
 - Administration Date



Test Case Expectations

- Forecast results:
 - Dose Number
 - Valid Date (earliest date)
 - Due Date
 - Overdue Date
- Evaluation results:
 - Not tested directly
 - Future improvement



Login

The screenshot shows a Firefox browser window displaying the Texas Children's Hospital Immunization System login page. The page features a navigation bar with 'Login', 'Register', and 'Request Password' buttons. Below the navigation bar is the Texas Children's Hospital logo and the text 'Texas Children's Hospital'. A welcome message reads: 'Welcome to the TCH Immunization Forecast System Testing Application. The system has been designed for national cooperation and sharing of immunization forecast test cases and for supporting verification of forecast systems.'

Below the welcome message is a table with five columns: Expert, Task Group, Test Panel, Test Case, and Software. Each column contains a list of links or actions.

Expert	Task Group	Test Panel	Test Case	Software
Nathan Bunker <ul style="list-style-type: none">• Task Groups• Logout	TCH Expert Team <ul style="list-style-type: none">• Select• Test Panels• Experts	TCH Initial <ul style="list-style-type: none">• Select• Add Test Case	MMRV Mixed Test 21 <ul style="list-style-type: none">• Test Results• Forecast Log• Comments	TCH Forecaster Validator <ul style="list-style-type: none">• Select• Test Results• Run Tests

Below the table is the Texas Children's Hospital logo and the text 'Texas Children's Hospital Immunization System'. A footer bar contains the text: 'Texas Children's Hospital - Immunization Forecast Testing System - © 2012'.

Task Groups

Firefox

Home Page

Expert	Task Group	Test Panel	Test Case	Software
Nathan Bunker <ul style="list-style-type: none">• Task Groups• Logout	TCH Expert Team <ul style="list-style-type: none">• Select• Test Panels• Experts	TCH Initial <ul style="list-style-type: none">• Select• Add Test Case	MMR/V Mixed Test 21 <ul style="list-style-type: none">• Test Results• Forecast Log• Comments	TCH Forecaster Validator <ul style="list-style-type: none">• Select• Test Results• Run Tests

Select Task Group

Task Group	Software	Role	Select
CDS Workgroup	CDS Evaluator		<input type="button" value="SELECT"/>
IHS Expert Team	TCH Forecaster Validator	Expert	<input type="button" value="SELECT"/>
MIIS Expert Team	MIIS Forecaster		<input type="button" value="SELECT"/>
TCH Expert Team	TCH Forecaster Validator	Expert	<input type="button" value="SELECT"/>

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Expert Team

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Home Page

Expert	Task Group	Test Panel	Test Case	Software
Nathan Bunker • Task Groups • Logout	TCH Expert Team • Select • Test Panels • Experts	TCH Initial • Select • Add Test Case	MMR/V Mixed Test 21 • Test Results • Forecast Log • Comments	TCH Forecaster Validator • Select • Test Results • Run Tests

TCH Expert Team

Name	Role	Organization	Position	Email	Phone	
Julie Boom	Expert	TCH		jaboom@texaschildrens.org		REMOVE
Laura King	Expert	TCH		llking@texaschildrens.org		REMOVE
Leila Sahni	Expert	TCH		lcsahni@texaschildrens.org		REMOVE
Nathan Bunker	Expert	TCH		nabunker@texaschildrens.org		REMOVE
Rachel Cunningham	Expert	TCH		runcunni@texaschildrens.org		REMOVE
Choose One	Expert					ADD

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Test Panels

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Home Page

Expert	Task Group	Test Panel	Test Case	Software
Nathan Bunker <ul style="list-style-type: none">• Task Groups• Logout	TCH Expert Team <ul style="list-style-type: none">• Select• Test Panels• Experts	TCH Initial <ul style="list-style-type: none">• Select• Add Test Case	MMR/V Mixed Test 21 <ul style="list-style-type: none">• Test Results• Forecast Log• Comments	TCH Forecaster Validator <ul style="list-style-type: none">• Select• Test Results• Run Tests

Select Test Panel

Test Panel	Select
TCH 2012 Influenza	<input type="button" value="SELECT"/>
TCH Initial	<input type="button" value="SELECT"/>

Create Test Panel

Label	<input type="text"/>
<input type="button" value="CREATE"/>	

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Test Panel Cases

Firefox

Home Page

Expert

Nathan Bunker
• Task Groups
• Logout

Task Group

TCH Expert Team
• Select
• Test Panels
• Experts

Test Panel

TCH Initial
• Select
• Add Test Case

Test Case

MMRV Mixed Test 21
• Test Results
• Forecast Log
• Comments

Software

TCH Forecaster Validator
• Select
• Test Results
• Run Tests

TCH Initial

3Hib

Num	Test Case	Description	Patient	Include	Status	Select
62	3 Dose Hib Test 1	The earliest age for administr...	Mallory Ritter	Included	Pass	<input type="button" value="SELECT"/>
64	3 Dose Hib Test 2	Hib administered at 6 weeks an...	Kyra Murphy	Included	Pass	<input type="button" value="SELECT"/>
67	3 Dose Hib Test 3	Hib (Comvax) at 2,4,12 months ...	Drew Riddle	Included	Pass	<input type="button" value="SELECT"/>
70	3 Dose Hib Test 4	Dose 3 of Comvax must be admin...	Fatima Beatty	Included	Pass	<input type="button" value="SELECT"/>
73	3 Dose Hib Test 5	3 Comvax required for series c...	Charlie Drain	Included	Pass	<input type="button" value="SELECT"/>
76	3 Dose Hib Test 6	Less than 4 weeks between dose...	Kameron Summit	Included	Pass	<input type="button" value="SELECT"/>
78	3 Dose Hib Test 7	2 doses of Hib required if fir...	Dakota Timber	Included	Pass	<input type="button" value="SELECT"/>
79	3 Dose Hib Test 8	If first Hib is given at 12-14...	Devon Gardiner	Included	Pass	<input type="button" value="SELECT"/>
81	3 Dose Hib Test 9	If first Hib is administered a...	Eliza Chemult	Included	Pass	<input type="button" value="SELECT"/>
83	3 Dose Hib Test 10	1 dose of any Hib product admi...	Veronica Marcola	Included	Pass	<input type="button" value="SELECT"/>
84	3 Dose Hib Test 11	Hib administered before 6 week...	Amir Warren	Included	Pass	<input type="button" value="SELECT"/>

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Test Case

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Home Page

Expert	Task Group	Test Panel	Test Case	Software
Nathan Bunker <ul style="list-style-type: none"> • Task Groups • Logout 	TCH Expert Team <ul style="list-style-type: none"> • Select • Test Panels • Experts 	TCH Initial <ul style="list-style-type: none"> • Select • Add Test Case 	3 Dose HIB Test 1 <ul style="list-style-type: none"> • Test Results • Forecast Log • Comments 	TCH Forecaster Validator <ul style="list-style-type: none"> • Select • Test Results • Run Tests

Test Case

Label	3 Dose HIB Test 1
Description	The earliest age for administration of HIB is 6 weeks old. Before that is invalid.
Patient	Mallory Ritter (F)
Birth Date	01/01/2008
Evaluation Date	07/12/2011

Events

Type	Item	CVX	MVX	Date
Vaccination	Hep B, adolescent or pediatric	08		01/01/2008
Vaccination	Hib-Hep B	51		02/07/2008

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Find:

☐ Match case



Test Case Results

Firefox

Home Page

Expert	Task Group	Test Panel	Test Case	Software
Nathan Bunker <ul style="list-style-type: none">• Task Groups• Logout	TCH Expert Team <ul style="list-style-type: none">• Select• Test Panels• Experts	TCH Initial <ul style="list-style-type: none">• Select• Add Test Case	3 Dose HIB Test 1 <ul style="list-style-type: none">• Test Results• Forecast Log• Comments	TCH Forecaster Validator <ul style="list-style-type: none">• Select• Test Results• Run Tests

Hib Test Results

Entity	Dose	Valid	Due	Overdue
Expected by TCH Expert Team	1	03/06/2008	03/06/2008	04/01/2008
Actual from TCH Forecaster Validator	1	03/06/2008	03/06/2008	04/01/2008
Actual from MHS Forecaster	1	02/12/2008	03/01/2008	04/01/2008
Actual from TCH Nathan Dev Web1	1	03/06/2008	03/06/2008	04/01/2008
Actual from TCH ImmSys Prod	1	03/06/2008	03/06/2008	04/01/2008
Actual from TCH ImmSys Test	1	03/06/2008	03/06/2008	04/01/2008

Set Expected Values for Task Group

Dose:

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Find: [Next](#) [Previous](#) [Highlight all](#) ☐ Match case

Test Case Comments

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Comments

Expert	Organization	Date	Note
Unknown User	TCH	06/11/2010	Changed test status to PASS
Julie Boom	TCH	10/27/2010	Changed test status to PASS
Julie Boom	TCH	10/27/2010	Changed expected result. Dose number = 1. Valid date = 03/06/2008. Due date = 03/06/2008. Overdue date = 04/01/2008.
Julie Boom	TCH	10/27/2010	Changed expected result. Dose number = 1. Valid date = 03/06/2008. Due date = 03/06/2008. Overdue date = 04/01/2008.

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Find: mmr/v Next Previous Highlight all Match case

Select Software

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Home Page

Expert	Task Group	Test Panel	Test Case	Software
Nathan Bunker • Task Groups • Logout	TCH Expert Team • Select • Test Panels • Experts	TCH Initial • Select • Add Test Case	MMR/V Mixed Test 21 • Test Results • Forecast Log • Comments	TCH Forecaster Validator • Select • Test Results • Run Tests

Select Software

Software	URL	Schedule	Select
CDS Evaluator			<input type="button" value="SELECT"/>
MIIS Forecaster	http://69.64.70.10:8080/vfmservice/VFMWebService		<input type="button" value="SELECT"/>
TCH Forecaster Validator	http://tchforecasttester.org/fv/forecast		<input type="button" value="SELECT"/>
TCH ImmSys Prod	http://207.231.32.185:8081/web1/doForecastText.do		<input type="button" value="SELECT"/>
TCH ImmSys Test	http://207.231.32.186:8081/web1/doForecastText.do		<input type="button" value="SELECT"/>
TCH Nathan Dev FV	http://192.168.1.7:8221/fv/forecast		<input type="button" value="SELECT"/>
TCH Nathan Dev Web1	http://192.168.1.7:8221/web1/doForecastText.do		<input type="button" value="SELECT"/>

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Run Tests

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Home Page

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Nathan Bunker <ul style="list-style-type: none">• Task Groups• Logout	TCH Expert Team <ul style="list-style-type: none">• Select• Test Panels• Experts	TCH Initial <ul style="list-style-type: none">• Select• Add Test Case	3 Dose HIB Test 1 <ul style="list-style-type: none">• Test Results• Forecast Log• Comments	TCH Forecaster Validator <ul style="list-style-type: none">• Select• Test Results• Run Tests

Run Forecast Test

Run forecast test procedure for every test case listed in the currently selected test panel.

RUN FORECAST FOR ALL

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Find: mmr/v

Next Previous Highlight all Match case



Test Results

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Home Page

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Nathan Bunker <ul style="list-style-type: none">• Task Groups• Logout	TCH Expert Team <ul style="list-style-type: none">• Select• Test Panels• Experts	TCH Initial <ul style="list-style-type: none">• Select• Add Test Case	3 Dose HIB Test 1 <ul style="list-style-type: none">• Test Results• Forecast Log• Comments	TCH Forecaster Validator <ul style="list-style-type: none">• Select• Test Results• Run Tests

Test Results

Test Case	Run Date	Status	Similarity	Select
17 y/o with 2 doses of MCV4 now needs booster dose	08/30/2012	Same	100%	<input type="button" value="SELECT"/>
3 Dose HIB Test 1	08/30/2012	Same	100%	<input type="button" value="SELECT"/>
3 Dose HIB Test 2	08/30/2012	Same	100%	<input type="button" value="SELECT"/>
3 Dose HIB Test 3	08/30/2012	Same	100%	<input type="button" value="SELECT"/>
3 Dose HIB Test 3	08/30/2012	Same	100%	<input type="button" value="SELECT"/>
3 Dose HIB Test 4	08/30/2012	Same	100%	<input type="button" value="SELECT"/>
3 Dose HIB Test 4	08/30/2012	Same	100%	<input type="button" value="SELECT"/>
3 Dose HIB Test 5	08/30/2012	Same	100%	<input type="button" value="SELECT"/>
3 Dose HIB Test 5	08/30/2012	Same	100%	<input type="button" value="SELECT"/>
3 Dose HIB Test 6	08/30/2012	Same	100%	<input type="button" value="SELECT"/>

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Find: mmr/v ☐ Match case

Become Involved!

- Register at <http://tchforecasttester.org/ft/>
- Contact technical team to:
 - Bulk upload test cases
 - Connect your forecaster
- Contact Information
 - Nathan Bunker – nabunker@texaschildrens.org
 - Bill Adams – badams@bu.edu