Measles Preparedness: Leveraging a Collaborative, Interoperable Approach

Sarah Winders, MPH, Madison Toney, MPH, CPH, Rana Zakaria, MPH

Response Planning

Proactive Measles Response Planning

- As measles cases and outbreaks emerged in other jurisdictions, we acted early to strengthen our readiness and ensure a coordinated, effective response
  - **Emergency Preparedness (EP) Coordination**
    Held regular meetings with EP staff to align efforts and strengthen response capacity
  - **Response Plan Review**
    Engaged EP and program staff to review existing plans and identify operational gaps
  - **REDCap Investigation Forms**
    Built user-friendly forms to accurately and efficiently collect case and contact information, enabling real-time data entry and field usability
  - **TennIIS Campaign Capability Assessment**
    Explored roles and resources by asking:
    "What can we use?" and *"What would we need?"* to activate a vaccine campaign
  - **Incident Command Structure (ICS)**
    Developed a measles-specific ICS in collaboration with program leadership, EP, and department leadership to ensure clear roles, communication, and rapid mobilization

Data Collection & Analysis Team

- As members of the Data Collection & Analysis branch within the Measles ICS structure, Sarah, Shelby, and Madison met regularly to align on data needs, workflows, and visualization goals
  - **Data Strategy & Collaboration**
    The team coordinated to determine what data was needed, how it should be collected, and how it would be shared to support response efforts
  - **Case & Contact Data Collection (Sarah)**
    Curated and refined the existing REDCap investigation form to support accurate and consistent case and contact tracing
  - **Data Extraction & Preparation (Shelby)**
    Began building processes to pull key data elements from REDCap and prepare them for analysis and visualization
  - **Dashboard Design (Madison)**
    Designed the wireframe for a measles visualization dashboard, using existing public health dashboards as a model for structure and clarity

REDCap Case Investigation Form Development

REDCap Project Overview

Each record is either a case or a contact

can move from contact ⟶ case

Staff from the state & local health departments have access

External code for IIS matching and upload of results

Captures all info in one place

immunization history, contact tracing, lab, clinical, epi classifications

Survey for active daily monitoring

self-completed survey or PH phone call

Data connected to Tableau for visualizations

Dynamic Response – A Relay Race

Healthcare exposed patients line lists

Data Entry Team

Data Entry Team

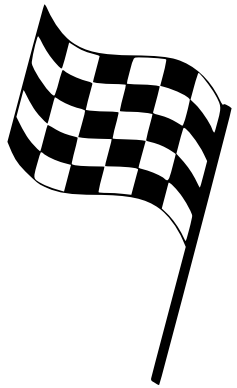
Local Public Health Staff

Local Public Health Staff

Data Management & Daily Monitoring

Data Management

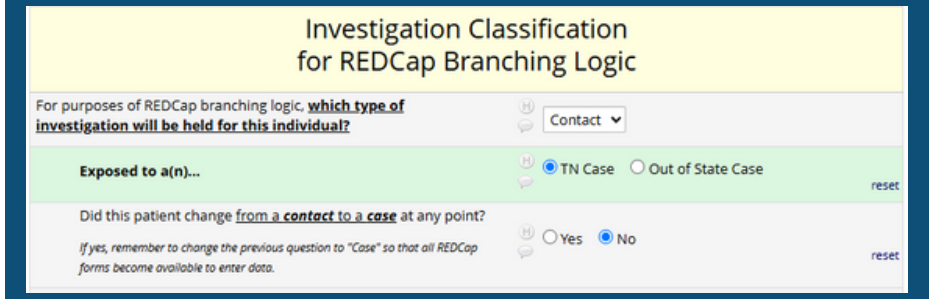
IIS Epis



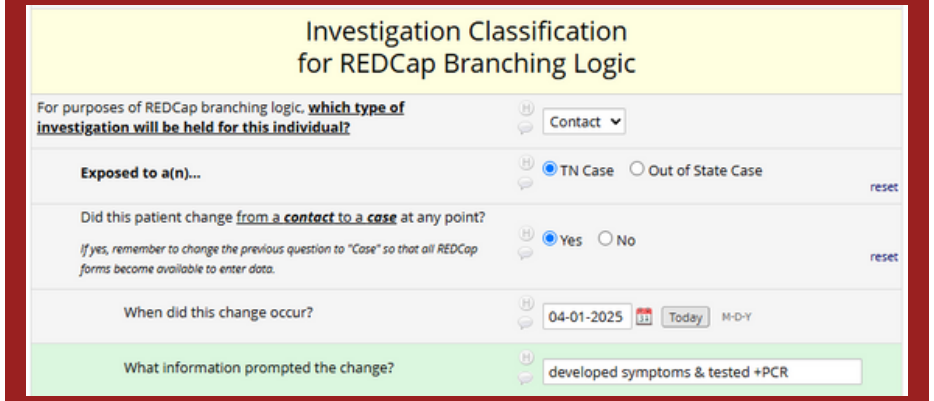
Cases & Contacts

Case

Contact

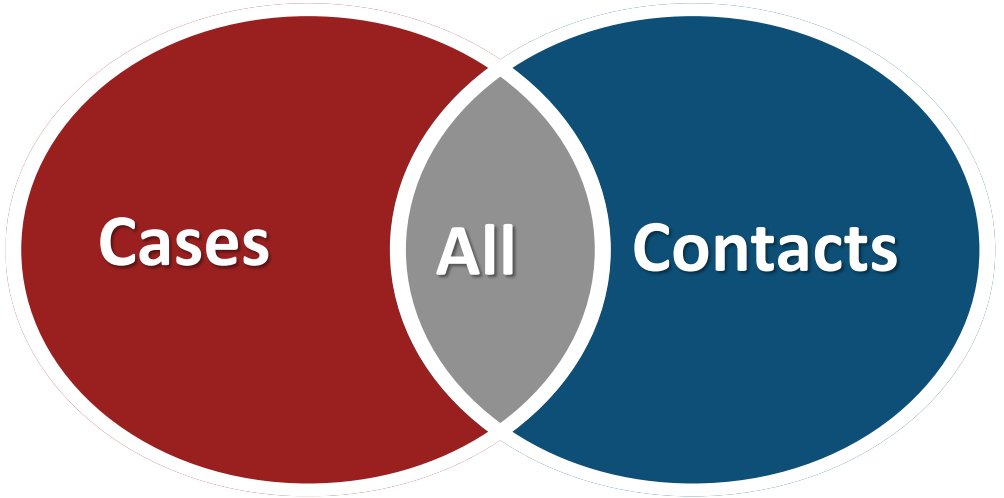


Contact ⟶ Case



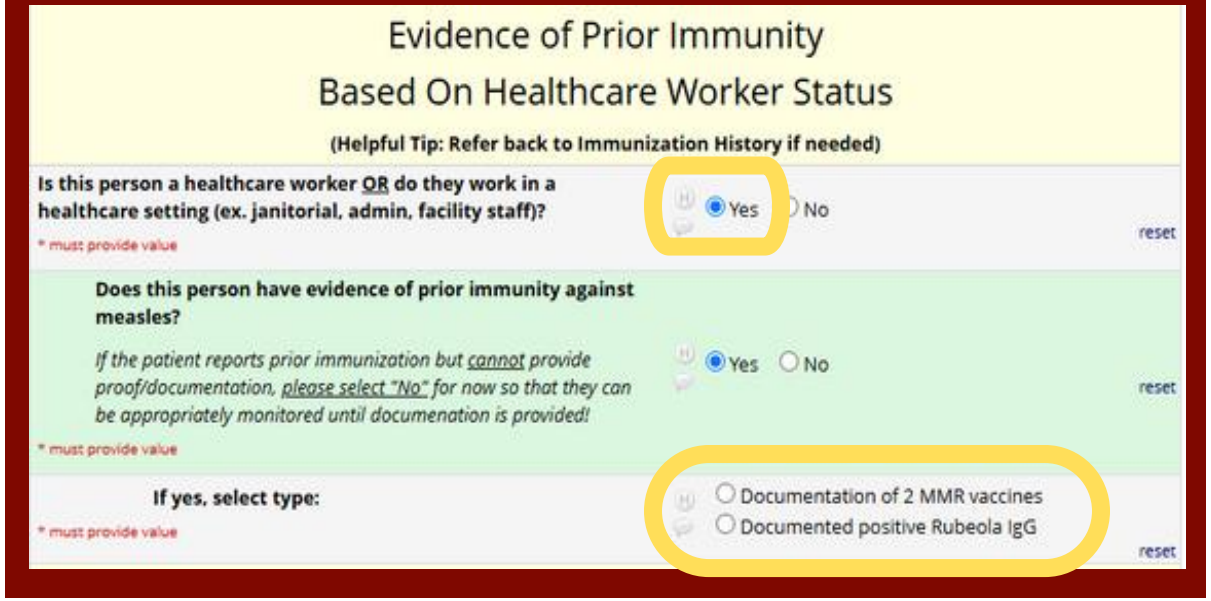
Form Display Logic

- Initial Reporting Source
- Demographics & Contact Info
- Immunization History
- Initial Symptom Info
- Measles Complications
- Contact Tracing
- Lab Tests
- Exposure, Prior Immunity & PEP
- Quarantine/Furlough Algorithm
- Daily Monitoring Survey
- Upload Documents
- Final Case Classification



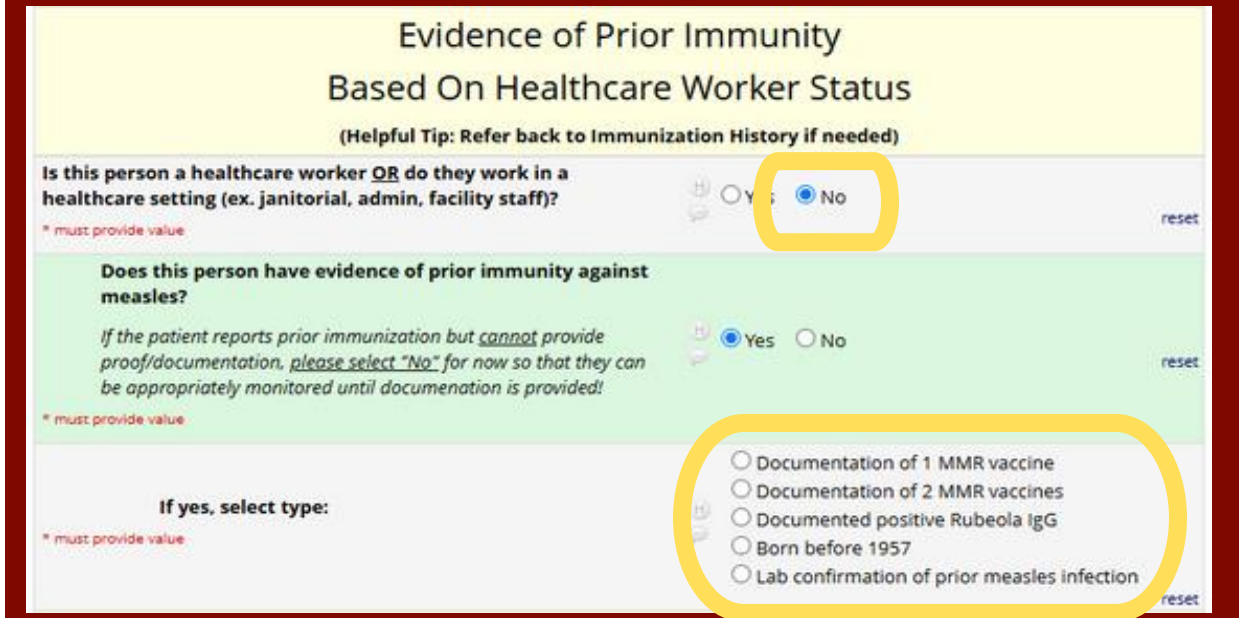
Branching Logic

Valid proof of immunity
Healthcare workers

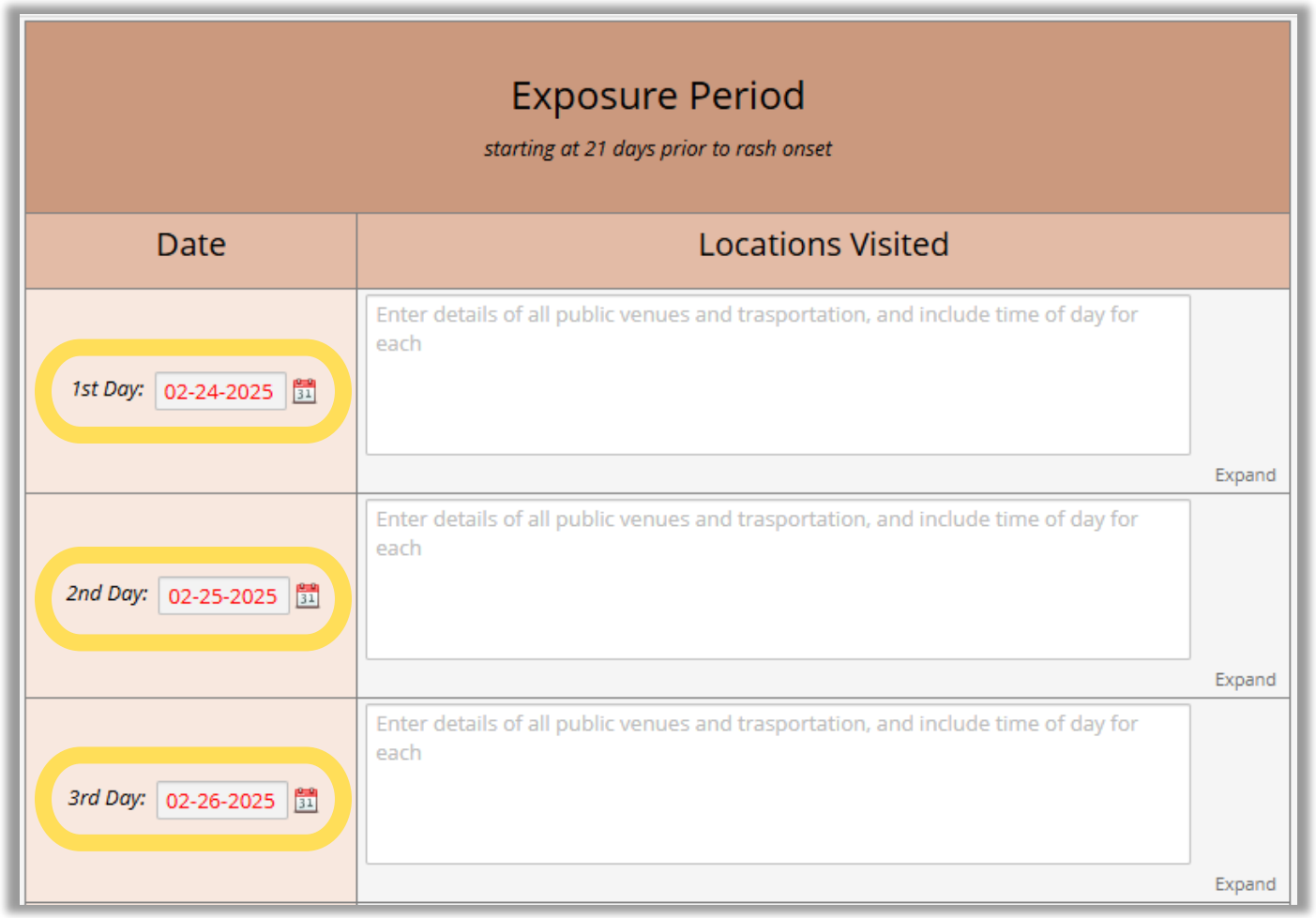


Branching Logic

Valid proof of immunity
Non-healthcare workers



Calculated Fields

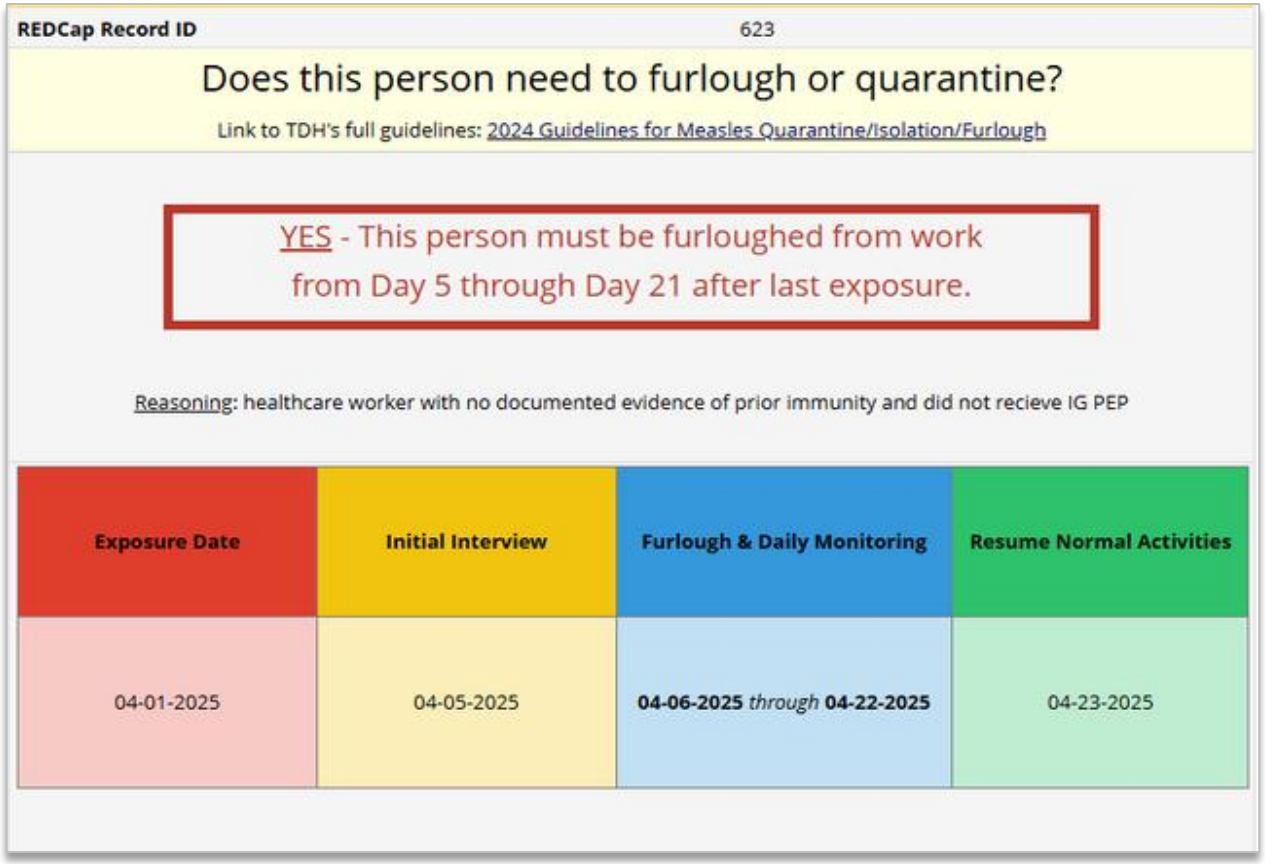


Exposure Period

starting at 21 days prior to rash onset

Date	Locations Visited
1st Day: 02-24-2025	Enter details of all public venues and trasportation, and include time of day for each Expand
2nd Day: 02-25-2025	Enter details of all public venues and trasportation, and include time of day for each Expand
3rd Day: 02-26-2025	Enter details of all public venues and trasportation, and include time of day for each Expand

Calculated Fields



REDCap Record ID 623

Does this person need to furlough or quarantine?

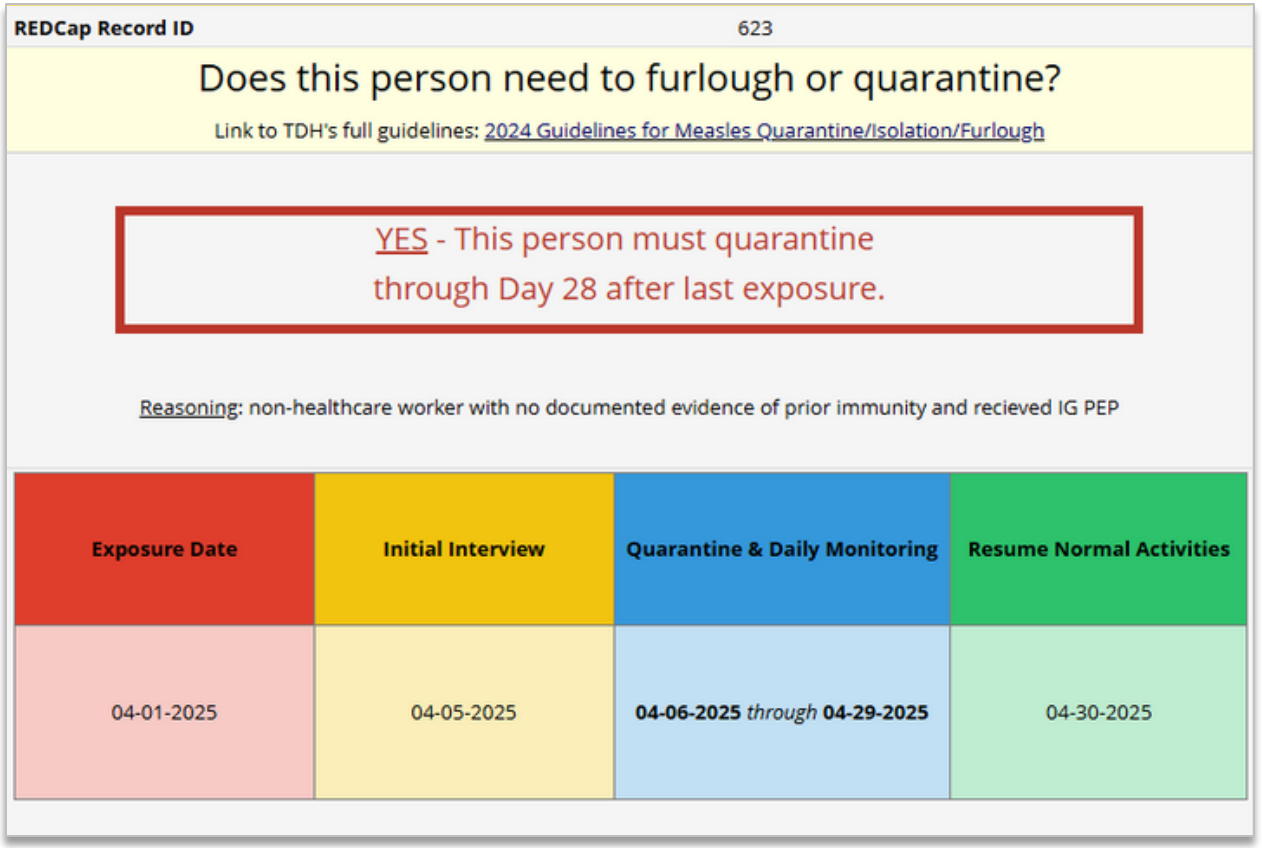
Link to TDH's full guidelines: 2024 Guidelines for Measles Quarantine/Isolation/Furlough

YES - This person must be furloughed from work from Day 5 through Day 21 after last exposure.

Reasoning: healthcare worker with no documented evidence of prior immunity and did not recieve IG PEP

Exposure Date	Initial Interview	Furlough & Daily Monitoring	Resume Normal Activities
04-01-2025	04-05-2025	**04-06-2025** *through* **04-22-2025**	04-23-2025

Calculated Fields



REDCap Record ID 623

Does this person need to furlough or quarantine?

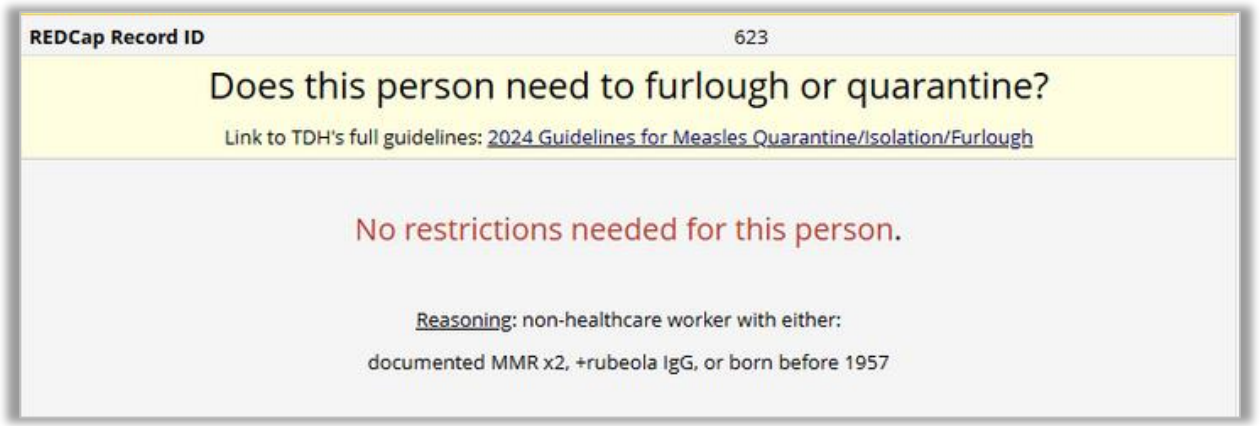
Link to TDH's full guidelines: 2024 Guidelines for Measles Quarantine/Isolation/Furlough

YES - This person must quarantine through Day 28 after last exposure.

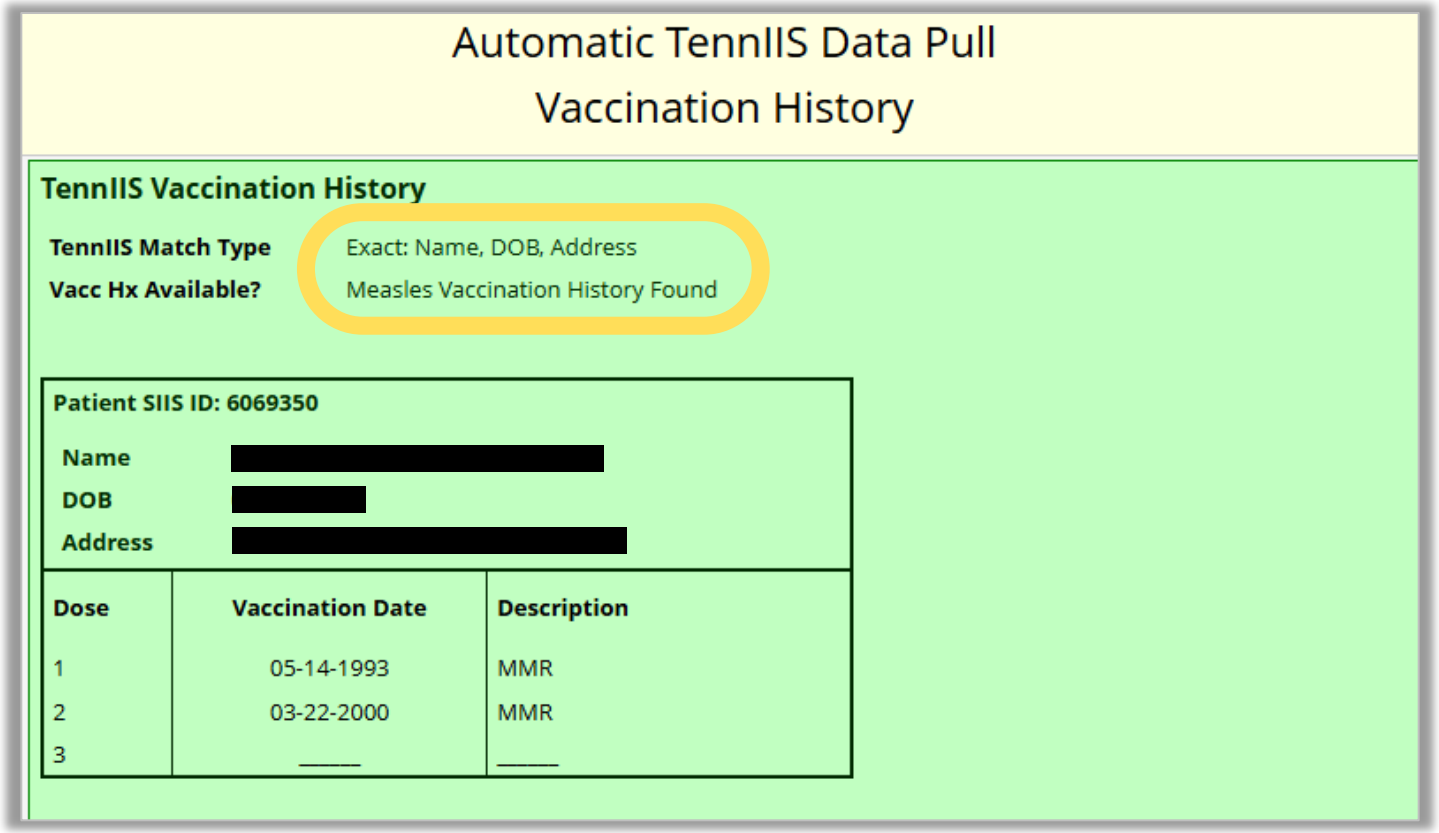
Reasoning: non-healthcare worker with no documented evidence of prior immunity and recieved IG PEP

Exposure Date	Initial Interview	Quarantine & Daily Monitoring	Resume Normal Activities
04-01-2025	04-05-2025	**04-06-2025** *through* **04-29-2025**	04-30-2025

Calculated Fields



Vaccine History – IIS Match



Automatic TennIIS Data Pull

Vaccination History

TennIIS Vaccination History

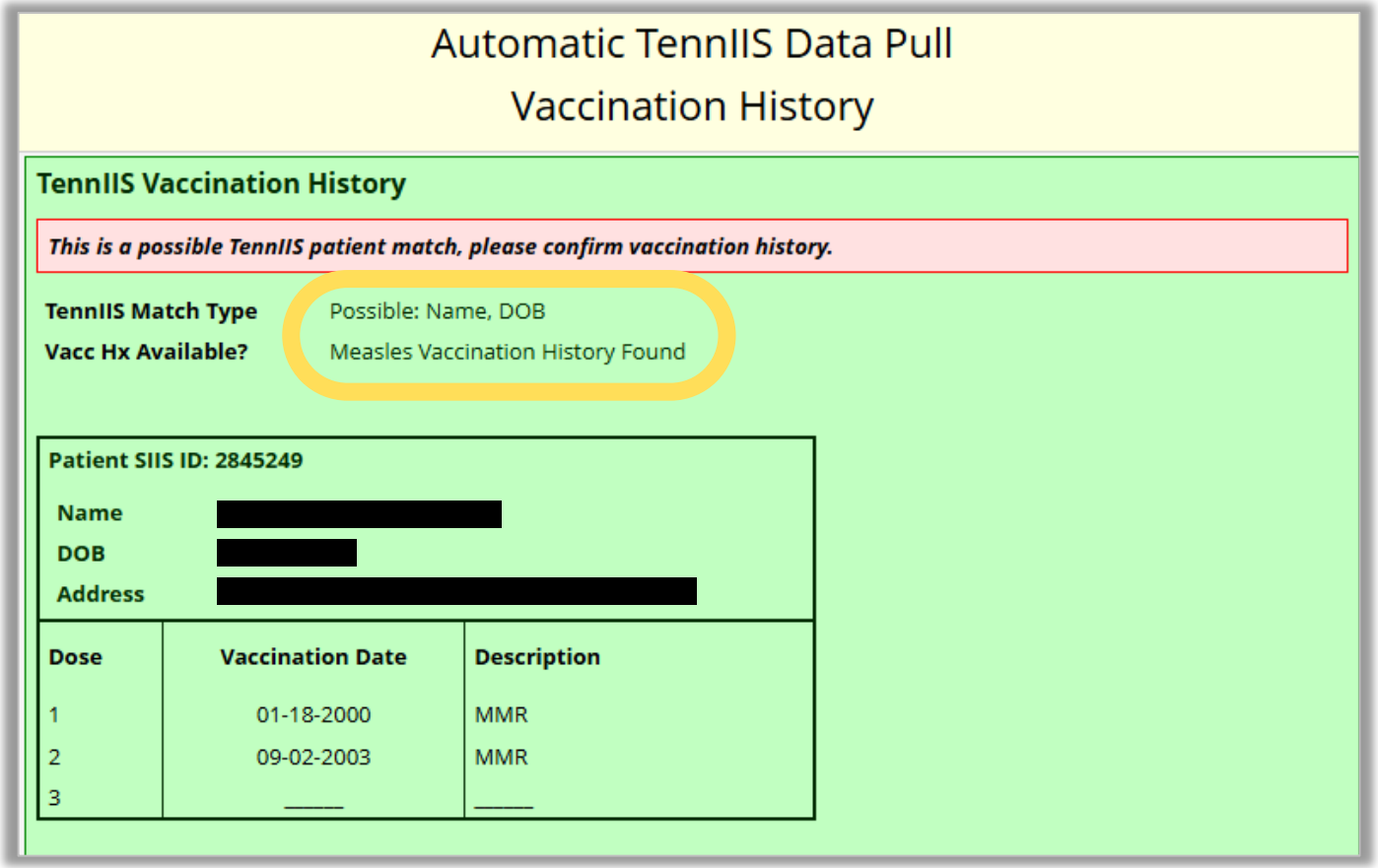
TennIIS Match Type	Exact: Name, DOB, Address
Vacc Hx Available?	Measles Vaccination History Found

Patient SIIS ID: 6069350

Name	[redacted]
DOB	[redacted]
Address	[redacted]

Dose	Vaccination Date	Description
1	05-14-1993	MMR
2	03-22-2000	MMR
3	_____	_____

Vaccine History – IIS Match



Automatic TennIIS Data Pull

Vaccination History

TennIIS Vaccination History

This is a possible TennIIS patient match, please confirm vaccination history.

TennIIS Match Type	Possible: Name, DOB
Vacc Hx Available?	Measles Vaccination History Found

Patient SIIS ID: 2845249

Name	[redacted]
DOB	[redacted]
Address	[redacted]

Dose	Vaccination Date	Description
1	01-18-2000	MMR
2	09-02-2003	MMR
3	_____	_____

Vaccine History – IIS Match

Automatic TennIIS Data Pull

Vaccination History

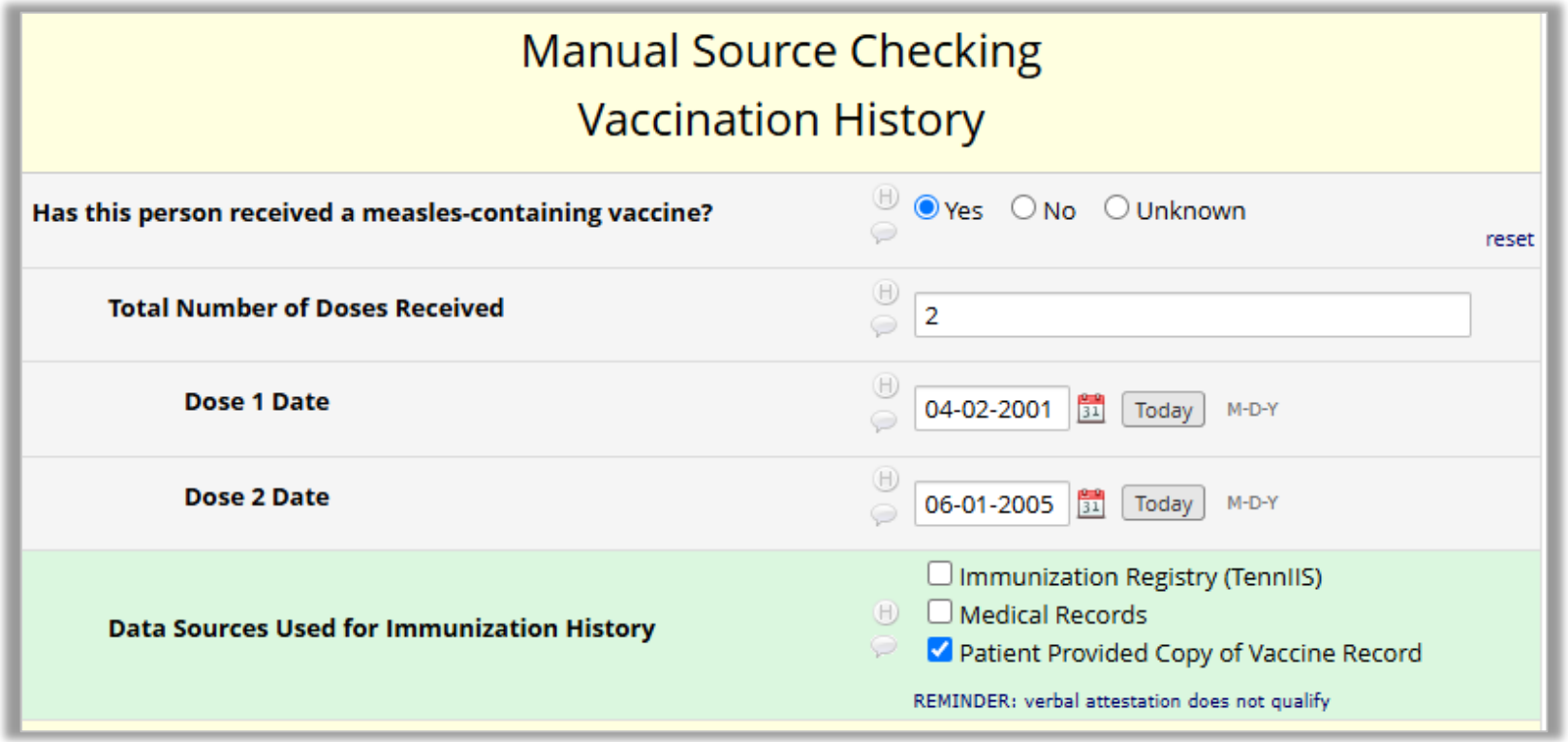
A patient match was not found in TennIIS. Please gather vaccination history.

Automatic TennIIS Data Pull

Vaccination History

TennIIS has not yet been checked for a patient match.

Vaccine History – Manual Data Entry



Daily Monitoring Survey

Text Consent:

Since this individual meets criteria for active/daily monitoring...

Do they consent to receive daily texts containing a link to a survey to complete which will ask if they have experienced any new symptoms?

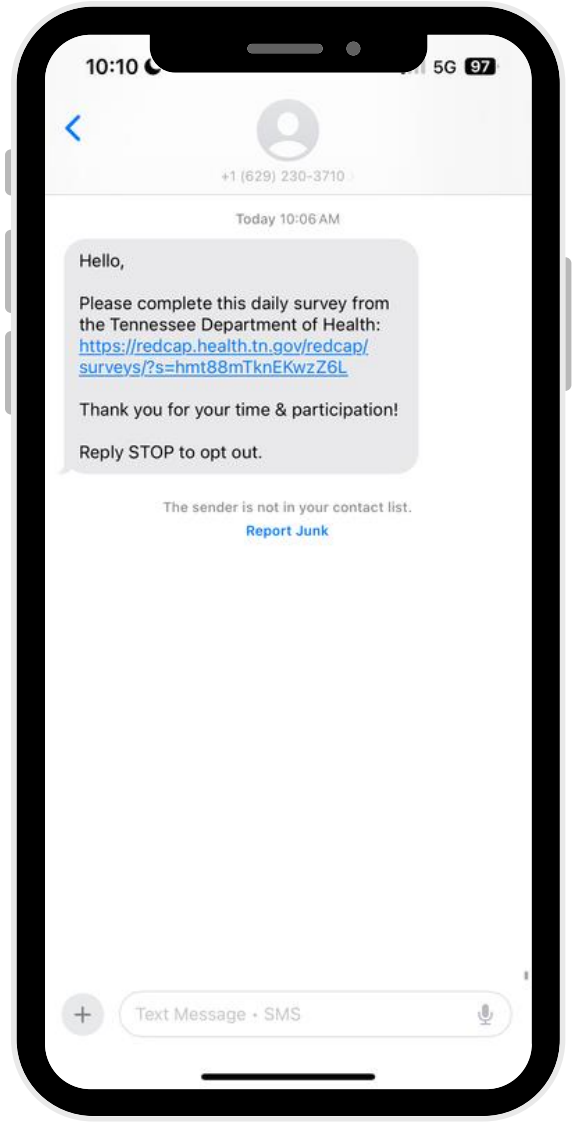
Texts will be sent at 10:00AM Central each day of their monitoring period, and a reminder text will be sent at 3:00PM if they have not responded.

If yes, please make sure the phone number on the Demographics page is up-to-date.

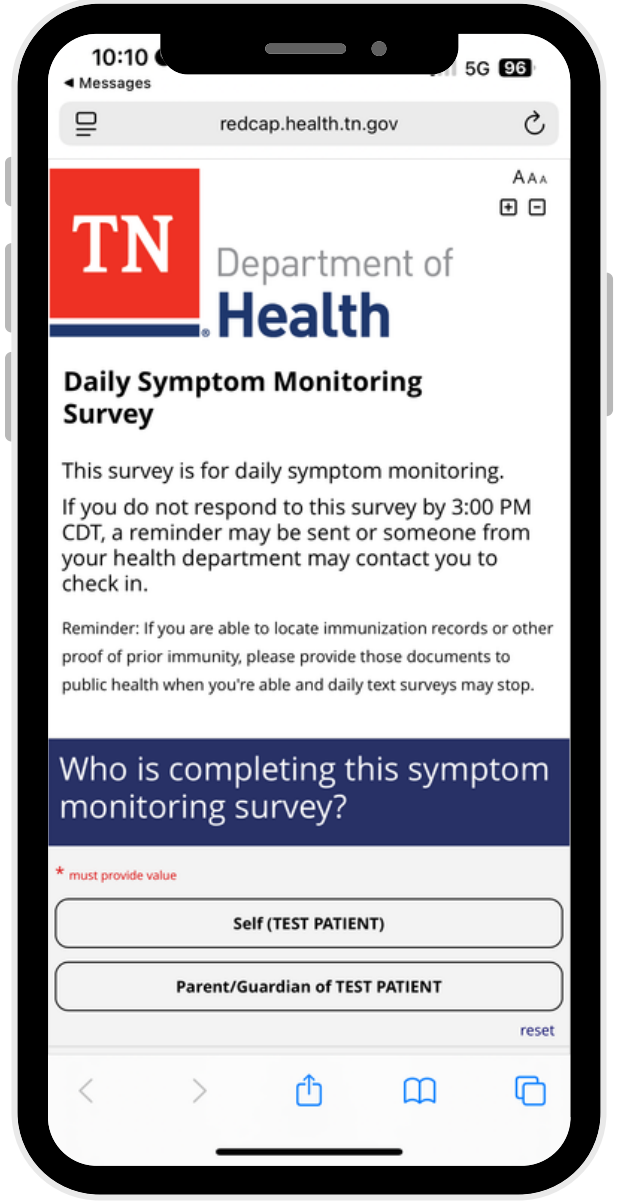
For reference, this is the phone number they can expect to receive these texts from: (629)-230-3710

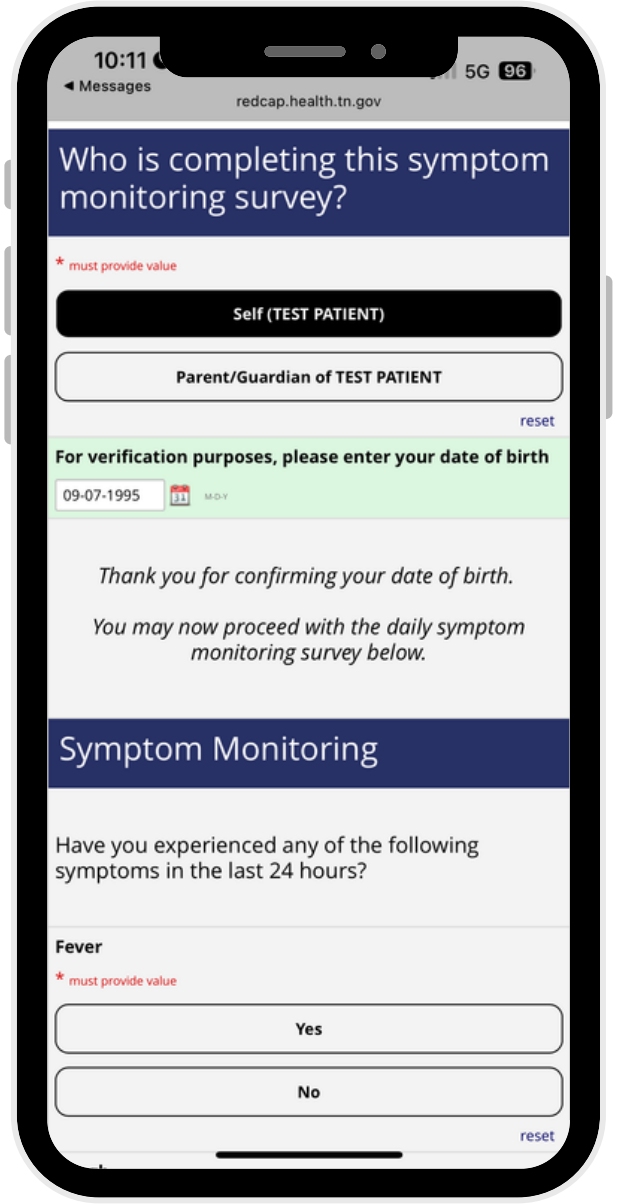
- (●) Yes, they are agreeable to a texted daily survey
- ( ) No, they prefer a daily phone call check-in
- ( ) No, they have requested to not be contacted again

reset



Daily Monitoring Survey





Vaccination History Auto-Matching

Anticipation of Rapid Scaling

- With measles highly infectious, we wanted to build our response process with the anticipation of needing to rapidly scale up
- Case investigators (CI)/Contact Tracers (CT) engaging with identified cases and contacts had initially needed to check measles vaccination history manually in TennIIS
- This can become tedious and time consuming if your patient list grows

- We decided to leverage the auto-matching process used by our clinical staff to fulfill TennIIS vaccination record requests
- This process uses a SAS code and an API to pull patient information from the REDCap project and match it against existing patient records in TennIIS

Vaccination History (Hx) Auto-Matching

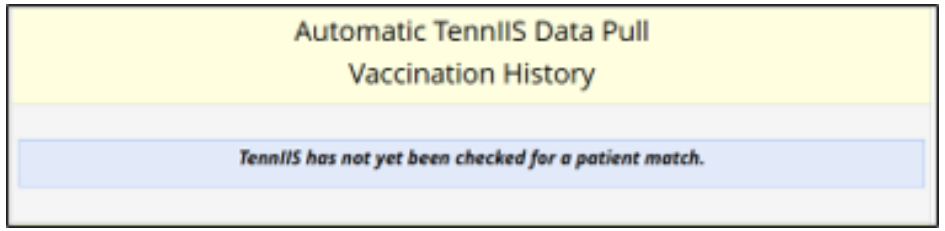
- Patient Match Categories:
  - Exact match – patient match found based on name, DOB, and address
  - Possible match – patient match found on name and DOB
  - No match – patient not found in TennIIS

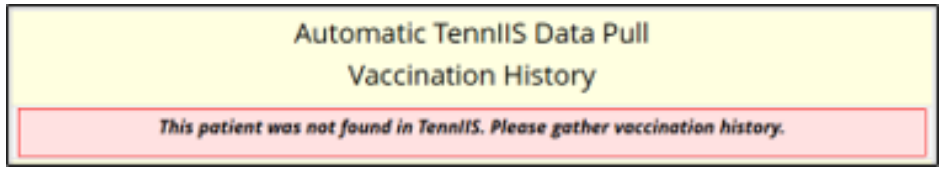
- After being assigned to a match category, patients are then matched to measles vaccination records in TennIIS based on their unique registry ID
  - If a was not found in TennIIS or if patient vaccination record did not contain any measles vaccinations, CI/CTs are prompted to confirm vaccination Hx during the interview

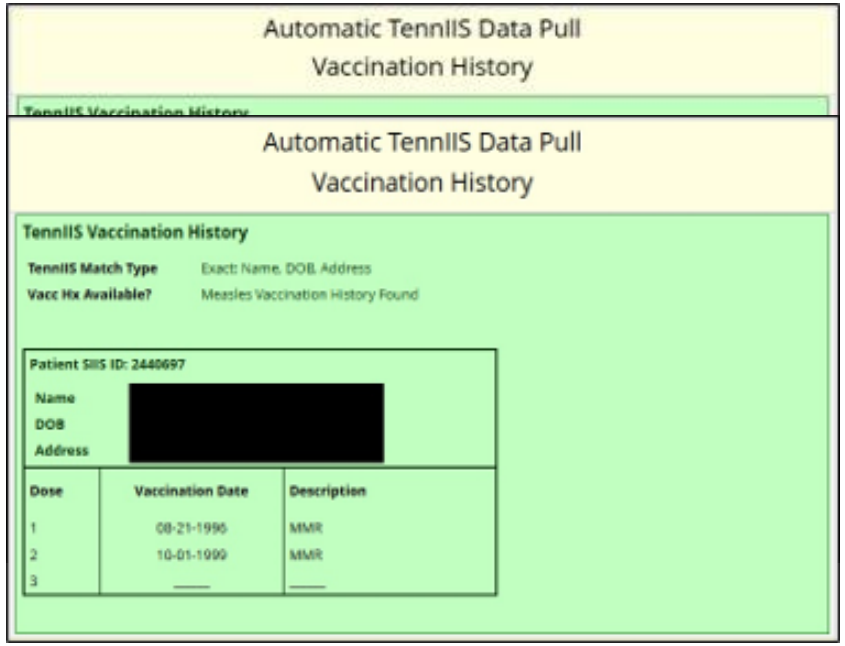
- The auto-matching code can be run multiple times a day as new patients are added to the REDCap
  - Once a patient has been matched against TennIIS records once, it is marked with an indicator so it is not included in future rounds of matching which keeps the code efficient

Populating the REDCap

- The final dataset is formatted to fit upload requirements for the REDCap project and is then transferred to a secure folder for the VPD team to upload and the team is notified via automated email







Data Visualization & Dashboard Development

Dashboard Development Overview

- **Inspiration & References**
  - Visualizations from Tennessee's COVID-19 response and measles dashboards from other jurisdictions guided the design and functionality of our dashboards
- **Purpose & Audience**
  - We identified and implemented key features to support both internal evaluation and public-facing communication:
    - Public Dashboard: Age, locality, vaccination status, etc. of cases
    - Internal Dashboard: Vaccine administration trends over time
- **Back-End Architecture**
  - SAS code connects securely to REDCap via API to retrieve curated data
    - Data is uploaded to an internal server that powers the dashboard
    - This setup enables automated data refreshes while maintaining multi-level data security

Tennessee Measles Dashboards

Measles Cases in Tennessee (2025)

Date last updated: **4/15/2025**
Data are updated every Friday. All data are provisional and subject to change.

Confirmed Cases	Hospitalizations	Deaths
6	0	0

Confimed Cases by Date of Rash Onset

Public Health Region

Public Health Region	Case Count	
Chattanooga-Hamilton County Region	0	0%
East Tennessee Region	0	0%
Jackson-Madison County Region	0	0%
Knoxville-Knox County Region	0	0%
Memphis-Shelby County Region	0	0%
Mid-Cumberland Region	2	33%
Nashville-Davidson County Region	0	0%
Northeast Region	0	0%
Southeast Region	0	0%
Sullivan County Region	0	0%
Upper Cumberland Region	4	67%
West Tennessee Region	0	0%

Age Group

Age Group	Case Count	
0-4 Years	0	0%
5-17 Years	4	67%
18-49 Years	1	17%
50+ Years	1	17%
Unknown	0	0%

Vaccination Status

Vaccination Status	Case Count	
Unvaccinated	6	100%
1 MMR Dose	0	0%
2 MMR Doses	0	0%
Unknown	0	0%

About the Data

Case counts represent the number of Tennessee residents who have been investigated by public health officials and confirmed to have measles.

Confirmed measles cases are defined as individuals with an acute febrile rash illness who meet one of the following criteria: (1) laboratory confirmation of measles virus, or (2) a direct epidemiologic link to a laboratory-confirmed case.

Date of reporting: If the rash onset date is unavailable, the specimen collection date used for laboratory confirmation is reported instead.

Vaccination status is determined using available sources, including the Tennessee Immunization Information System (TennIIS) and medical records, and reflects the individual's status at the time of illness onset. A status of 'unknown' may indicate that efforts to verify vaccination history are still in progress.

Public health region is determined by the case's residential address. A list of counties within each public health region is available here: https://www.tn.gov/health/health-program-areas/localdepartments.html.

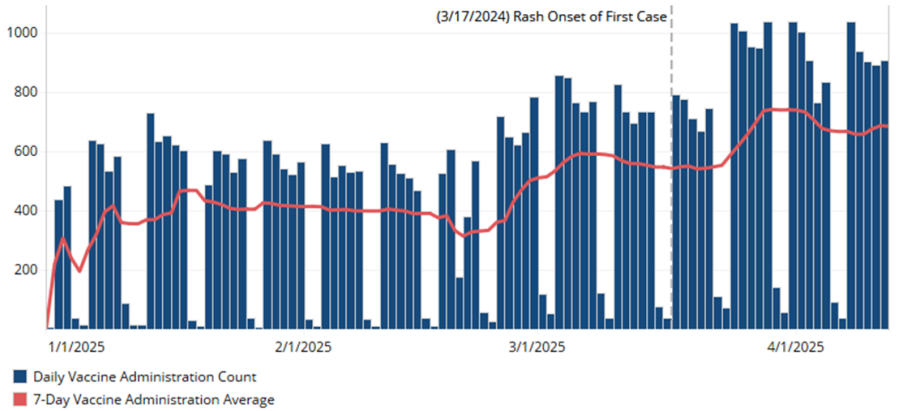
****INTERNAL USE ONLY****

Measles-Containing Vaccine Administration in Tennessee (2025)

Date last updated **4/15/2025**.
Data are updated every Friday. All data are provisional and subject to change.

Doses Administered Since First Measles Case D..	Doses Administered this Week: 4/13/2025 - 4/15/2025
19,913	1,377

Vaccinations Administered by Day



About the Data

All data are provisional and subject to change. Information is updated as additional details are received. The data shown reflect what is known to the Tennessee Department of Health (TDH) at the time when the numbers are updated.

Vaccines administered to Tennessee residents are reported to the Tennessee Immunization Information System (TennIIS). Data shown include the number of measles-containing vaccines administered to Tenneseans per day. Data reporting to the registry is not mandatory for all healthcare providers and therefore may not include all vaccines administered to Tennessee residents.

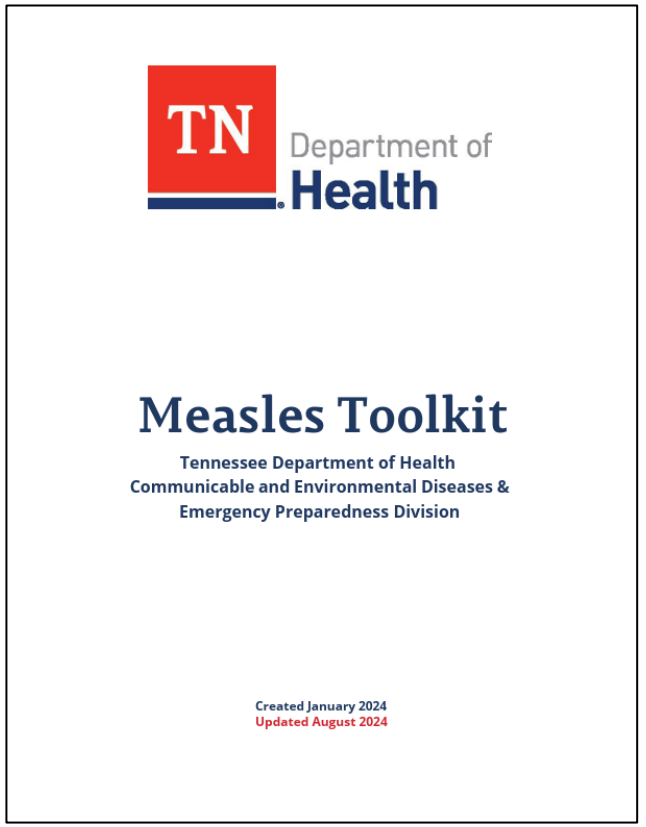
Measles Toolkit

Data in Action → Education & Information

- Rising measles cases across the U.S. led to increased inquiries from providers and the public early in 2024
- The initial response focused on developing internal education and materials for staff
- Our team identified need for centralized, accessible information for all audiences
- The Outreach Team (Rana) collaborated with our Surveillance Team (Sarah) to adapt technical content for broader use
- This resulted in the creation of the *Measles Toolkit,* a user-friendly resource for public education and provider support

Strengthening Provider Support and Public Communication

- **Provider Support**
  - The Measles Preparedness Toolkit is provider-focused featuring clinical guidance, diagnostic protocols, and reporting procedures.
  - In additional to technical content, we also created customizable communication templates to support provider-patient messaging during potential outbreaks.
- **Public Communication**
  - To also support and educate the public, we designed public-facing materials and FAQs to address common questions and promote vaccine confidence.



Moment of Truth…

Successful Implementation

- In September of 2024, Tennessee had its first measles “outbreak” since 2019.
  1. Sarah led statewide REDCap trainings with local health department staff, enabling a swift and effective response.
  2. Vaccination history was processed daily to ensure timely access for contact tracers.
  3. Tableau dashboards provided real-time analysis to support leadership decision-making.
  4. A standardized toolkit ensured consistent messaging across all communications.
- In March of 2025, Tennessee began to see an uptick in measles cases
  - As we continue to respond, ongoing improvements are being made to both REDCap and the dashboard

All-in-All

- Clear communication and strong teamwork streamlined efforts and improved coordination
- Even with preparation, not everything can be perfectly planned
- A cross-functional approach reduced manual workload and increased efficiency during the response

"Already done!"

Special Thanks

We would like to extend a special thank you to

Shelby Davis, MPH, CPH for her contributions to planning and implementation of the API for auto-matching!

Thank you!