Outpatient Management of Patients Under Investigation (PUIs) for Measles Virus

*Suspect cases should call prior to going to an urgent care facility, primary care physician, or hospital

Screen and Identify – Signs and Symptoms

- High fever, cough, red eyes, runny nose
- Rash (starts on face, spreads down to neck, trunk, arms, legs, feet)
- Ask: Travel to area with measles or exposure to visitor from area with measles ([https://www.cdc.gov/measles/cases-outbreaks.html](https://www.cdc.gov/measles/cases-outbreaks.html))
- Ask: Immunization status

Isolate

- If notification received in advance of arrival
  - Instruct patient to continue waiting outside or in vehicle
  - Inquire regarding symptoms, exposure, travel and immunization status
  - Call Infection Prevention immediately to arrange assessment and isolation
- If patient presents without prior notification
  - Provide masks for patients at entrance
  - Promptly place mask on patient and move to private room (patient must continue to wear mask in private room)
  - Door to exam room must remain closed and unoccupied for a minimum of 2 hours after patient leaves room (Usual cleaning/disinfection can occur after this 2 hour wait)
- All health care providers entering the room must wear mask (even if vaccinated)
- Prefer non-pregnant staff with confirmed immunity provide care of suspect cases
- Obtain measles antibody serum sample, throat/nasopharyngeal swab and urine for laboratory confirmation

Inform

- Report IMMEDIATELY to Infection Prevention
  - 828-213-5460; On-Call: 828-776-5216
- Local health department

Transfer (as needed)

- Require facility with airborne isolation capacity
- Notify receiving facility and EMS (if utilized) in advance
Fever, Rash and Travel?

Consider Measles.

Measles cases continue to be identified in returning international travelers and travel related to U.S. outbreaks. Measles is highly contagious. Please help protect patients, visitors and staff.

Consider measles in people with:

**Compatible illness**

- **PRODROME**
  - Fever, often high
  - Cough, coryza, conjunctivitis
  - Koplik spots

- **RASH ONSET (usually 14 days after exposure)**
  - Begins a few days after onset prodrome
  - Maculopapular rash begins on face and head
  - Spreads to trunk then extremities (down and out)
  - Fades in order of appearance

**Potential source of exposure in 3 weeks prior**

- International travel
- Travel to outbreak-affected area
- Contact with people with similar symptoms

**No history of vaccination or evidence of immunity**

*Note: Not all people with measles will meet all of these criteria.*

If you suspect measles, act immediately.

- Implement airborne precautions; mask and isolate patient to a negative pressure room if available.
- Permit only staff with written documented immunity to measles to be near the patient.
- Contact your local health department or the Division of Public Health (919-733-3419; 24 hours a day/seven days a week) immediately to discuss testing and control measures.
- Notify receiving facilities before referring or transferring patients to avoid exposures.
- Do not use any regular exam room for at least two hours after a suspected measles patient has left the room.

Visit [https://epi.publichealth.nc.gov/cd/diseases/rubeola.html](https://epi.publichealth.nc.gov/cd/diseases/rubeola.html) for more information.

Adapted with permission from California Department of Public Health, Immunization Branch.
ASSESSMENT OF SUSPECTED MEASLES CASES

Given the recent increase in the number of suspected measles calls, The NC Communicable Disease Branch (CDB) wanted to share general criteria for evaluation that may be useful to you when assessing whether measles testing should be approved by CDB for testing at the NC State Laboratory of Public Health (SLPH). Approval is required and must be discussed with the Epidemiologist On Call at 919-733-3419.

Testing is reserved for those cases most likely to have measles (such as unvaccinated travelers) or those with fever and generalized maculopapular rash with strong suspicion of measles. Because approving testing indicates that we have a strong suspicion for measles, it also often indicates the need to implement control measures (isolating suspected cases, identifying contacts, assessing for evidence of immunity, and implementing quarantine and post exposure prophylaxis (PEP) if indicated. In most circumstances, testing should not be approved for patients with no known risk factors for measles (such as fully-immunized NC residents with no travel history).

Consider these factors when determining the level of suspicion for measles:

1. **Immune Status** – Persons who meet the criteria for acceptable evidence of immunity (described below) have a very high likelihood of immunity and are unlikely to acquire measles. Measles vaccine is highly effective [1 dose: 93%, 2 doses: 97%] and is believed to produce life-long immunity. Evidence of immunity includes:
   a. History of age-appropriate vaccination,
   b. Birth before 1957 in the United States, or
   c. Laboratory evidence of immunity.

2. **Exposure History** – Inquire about potential sources of infection in the 21 days prior to onset such as:
   a. International travel,
   b. Domestic travel to locations with known cases,
   c. Contact with persons with similar symptoms, or
   d. Contact with known or suspected cases.

3. **Clinical Picture** – Consider if the clinical picture is compatible with measles and if the case definition is met.
   a. Prodrome:
      i. High fever (stepwise increase, can be up to 105⁰)
      ii. Cough, coryza, conjunctivitis
      iii. Koplik spots (tiny white spots in the mouth with bluish-white centers)
   b. Rash (usually 14 days after exposure):
      i. Begins a few days after onset prodrome
      ii. Maculopapular rash begins on face and head
      iii. Spreads to trunk and then extremities (downward and outward)
      iv. Fades in order of appearance

4. **Other Causes** – Consider other possible causes for the illness. Inquire about:
   a. Recent use of antibiotics,
   b. Contact with cases of rash illness with known etiology (e.g. parvovirus or fifths disease, coxsackie or hand, foot and mouth disease, roseola or humanherpes virus 6-7, strep or scarlet fever), and
   c. Other testing that was performed (RMSF).

The local health department investigation steps for measles are available in the CD Manual. Other materials, such as post-exposure prophylaxis guidelines, isolation and quarantine information and templates are also available if needed.

Vaccine Preventable Disease Program
NC Communicable Disease Branch
Rev. 02122019
NCSLPH Measles Specimen Collection and Testing Guidelines, 6/25/2018

Testing Criteria for Measles: All suspect or probable cases of measles must be reported to the Communicable Disease Branch at (919) 733-3419 for prior approval for laboratory testing. Individuals presenting with fever, cough, coryza and/or conjunctivitis, and a rash are considered suspect cases.

Testing Systems Employed: Serological specimens will be evaluated at the NCSLPH using an Indirect Immunofluorescent Antibody (IFA) test to detect IgM and IgG antibody. Nasopharyngeal (NP) swabs, throat swabs, and urine will be processed for viral isolation and PCR analysis at the NCSLPH.

SPECIMENS SHOULD BE COLLECTED AT THE FIRST CONTACT WITH A SUSPECTED CASE

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Test</th>
<th>Specimen Volume</th>
<th>Shipment</th>
<th>Expected TAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum*</td>
<td>IgM and IgG IFA</td>
<td>1 – 3 ml</td>
<td>Refrigerated (4°), place on cold packs</td>
<td>1 – 2 days</td>
</tr>
<tr>
<td>NP or Throat Swab</td>
<td>Viral Culture**</td>
<td>2 ml VTM</td>
<td>Refrigerated (4°), place on cold packs</td>
<td>Culture: 1 - 2 weeks PCR: 3 days</td>
</tr>
<tr>
<td>Urine</td>
<td>Viral Culture**</td>
<td>15 ml (20 – 35 ml preferred)</td>
<td>Refrigerated (4°), place on cold packs</td>
<td>Culture: 1 - 2 weeks PCR: 3 days</td>
</tr>
</tbody>
</table>

*Note: Optimal collection for this specimen type is >3 days post-onset of rash. Collection prior to this time may result in a false negative test due to the lack of detectable levels of IgM and IgG immunoglobulin.

**Note: Measles virus isolation is most successful when samples are collected on the first day of rash through 3 days following onset of rash; however, it is possible to detect virus up to day 7 following rash onset.

SPECIMEN COLLECTION AND STORAGE

- Collection instructions for viral culture:  
  **Nasopharyngeal Swab** – Carefully swab the posterior nasopharyngeal area via the external nares with a dry sterile tipped swab. Break off the swab tip into a vial containing 2 ml of viral transport medium. Screw the cap on tightly.
**Throat Swab** – Vigorously rub the posterior wall of the pharynx with a dry, sterile, swab. The swab should not touch the tongue or buccal mucosa. Break off the swab tip into a vial of viral transport medium. Screw the cap on tightly.

**Urine:** Collect clean voided urine. Transfer to a plastic shipping tube.

- All specimen types should be refrigerated promptly after collection. Temporary storage and transport temperature should be 4° - 8°C. DO NOT FREEZE.
- Clearly label each specimen with patient's first and last name, either date of birth, SSN, or other unique identifier, specimen source, and collection date.
- Complete the appropriate specimen submission forms and request Measles testing only during times of active Measles surveillance:
  - Serological specimens: DHHS# 3445, found at http://slph.ncpublichealth.com/Forms/DHHS-3445-SpecialSerology-20130809.pdf
  - Include the statement: “Prior approval/consultation received from:” the name of the individual in the Communicable Disease Branch that provided approval for testing.
- **Do not use calcium alginate tipped OR wooden shafted swabs.** Calcium alginate may inactivate some viruses. Wooden shafts may be toxic to viruses.

**SHIPPING OF DIAGNOSTIC SPECIMENS (PLEASE NOTE THE CHANGE OF ADDRESS)**

- Ship specimen(s) to the State Laboratory the same day collected.
- Wrap the properly labeled inoculated transport medium (primary container) or serological specimen in absorbent material, i.e. paper towel, and place into a leak proof secondary container (50ml conical tubes).
- Place two frozen ice packs in the shipping container.
- Place secondary container(s) containing specimen(s) between the ice packs.
- Place completed forms in plastic bag and slide into space at narrow end of ice pack.
- Ship specimens to:
  - Attention: Virology/Serology
  - North Carolina State Laboratory of Public Health
  - 4312 District Drive
  - Raleigh, NC 27607-5490
- Ship specimens by the fastest means possible. Transit time of less than 24 hours will optimize virus detection.

Please contact John Bunting (919-807-8824) or Segun Awe (919-807-8821) at the NCSLPH if you have questions regarding sample collection or shipment.
FAQs on Measles Immunity  
5/1/2019

I have patients in their 60s and older asking if they need the MMR vaccine. Do they?

- If a person was born before 1957, they are considered immune to measles and do not need to be immunized for it.
- People born before 1957 lived through several years of epidemic measles before the first measles vaccine was licensed in 1963, so they are very likely to have had measles disease.
- However, while serologic testing (“titers”) are not recommended to check immunity in this population, if someone born before 1957 had serologic testing and it showed they are not immune (and they have no documentation of at least 1 dose of MMR), they should get at least 1 dose of MMR.

What is considered evidence of immunity to measles for the general public?
Per the Advisory Committee on Immunization Practices, at least one of the following:

- written documentation of adequate vaccination
  - one or more doses of a measles-containing vaccine** administered on or after the first birthday for preschool-age children and adults not at high risk
  - two doses of measles-containing vaccine for school-age children and adults at high risk (i.e., college students, healthcare personnel, and international travelers)
- laboratory evidence of immunity
- laboratory confirmation of measles
- birth before 1957

**Individuals who previously received a dose of MMR vaccine in 1963–1967 and are unsure which type of vaccine it was, or are sure it was inactivated measles vaccine, should be revaccinated with either one (if low-risk) or two (if high-risk) doses of MMR vaccine.

What is the recommendation for measles immunity for healthcare personnel (HCP)?
ACIP recommends that all HCP born during or after 1957 have adequate presumptive evidence of immunity to measles, mumps, and rubella, defined as one of the following:

- written documentation of 2 doses of measles and mumps vaccine and at least 1 dose of rubella vaccine,
- laboratory evidence of immunity, or
- laboratory confirmation of disease.

For unvaccinated HCP who were born before 1957, ACIP recommends that healthcare facilities consider vaccination if those HCP lack laboratory evidence of measles, mumps, and/or rubella immunity or laboratory confirmation of disease.

During an outbreak of measles or mumps, healthcare facilities should recommend 2 doses of MMR separated by at least 4 weeks for unvaccinated healthcare personnel regardless of birth year who lack laboratory evidence of measles or mumps immunity or laboratory confirmation of disease.
Would you consider healthcare personnel with 2 documented doses of MMR vaccine to be immune even if their serology (“titers”) for 1 or more of the antigens comes back negative?

- Yes. HCP with 2 documented doses of MMR vaccine are considered to be immune regardless of the results of a subsequent serologic test for measles, mumps, or rubella.
- Documented age-appropriate vaccination outweighs the results of subsequent serologic testing.
  - Why? Because the serology tests used by commercial labs may not be sensitive enough to reliably detect vaccine-induced immunity; they are better at detecting immunity from the actual illness.
  - Therefore, ACIP does not recommend serologic testing after vaccination with MMR.

How do I interpret serologic test results of “indeterminate” or “equivocal”?

- Consider those results to be the same as “not immune.”

References:

2019 Measles Update

Susan Sullivan MS, RN-BC VPD Nurse Consultant
Justin Albertson MS, VPD Epidemiologist

April 2019
Objectives

• Discuss measles clinical presentation
• Review current epidemiology
• Discuss appropriate lab testing
• Describe control measures
Measles

• Acute viral illness

• Transmitted via airborne particles or droplets
  – Airborne virus can remain infectious for up to 2 hours after a case occupied that space

• Incubation period: 7-21 days (average 14 days)
• Infectious period: 4 days before and after rash onset

• Prevented by measles-mumps-rubella vaccine (MMR)
  – 2 doses recommended (1 dose-93%; 2 doses-97% effectiveness)
  – 1\textsuperscript{st} at 12-15 months of age
  – 2\textsuperscript{nd} at 4-6 years of age
Clinical Picture

- **Prodrome (typically lasts 2-4 days)**
  - High fever (up to 105°), cough, coryza (runny nose), conjunctivitis
  - Koplick spots

- **Rash (typically lasts 4-7 days)**
  - Begins a few days after prodrome
  - Maculopapular (flat lesions and small, solid raised lesions)
  - Begins on head and face
  - Spreads to trunk and extremities
  - Fades in order of appearance
Other Fever/Rash Causes

- Fifth’s Disease-parvovirus
- Hand, Foot and Mouth Disease- coxsackie virus
- Roseola-human herpesvirus 6, 7
- Scarlet fever-strep
- Rocky Mountain Spotted Fever
- Recent antibiotic use
- Contact dermatitis
- Heat rash
- Recent MMR vaccination

In sexually active adults, please rule out syphilis
Measles Lab Testing

- **PCR (NC SLPH w CD Branch approval)**
  - Throat or nasopharyngeal swab
  - Urine
  - Collect within 3 days of rash onset
  - NC SLPH now able to perform measles PCR

- **IgM (any commercial lab)**
  - Serum specimen
  - Collect 3 days or later after rash onset
  - In vaccinated persons, there is often a blunted and/or transient production of IgM
  - Negative IgM in vaccinated persons suspected of having measles should not be used to rule out the case

- **Viral culture (LabCorp)**
Measles in the U.S.

• Still common in Europe, Asia, the Pacific, and Africa
• Travelers with measles continue to bring disease into U.S.
• Measles spreads in a community where groups of people are unvaccinated
• Large majority of people who get measles are unvaccinated

https://www.cdc.gov/measles/cases-outbreaks.html
Global View

Distribution of measles genotypes
year 2015

Data source: Measles Database;
Data in H3 as of 7 March 2016

Note: Pie chart proportional to the number of sequenced viruses;
China data has been adjusted by size (total genotyped = 2062).
Measles in the U.S.

NUMBER OF MEASLES CASES REPORTED BY YEAR
2010–2019** (as of April 26, 2019)

Year


Number of cases

63 220 55 187 667 188 86 120 372 704

https://www.cdc.gov/measles/cases-outbreaks.html
Measles in North Carolina, 2009-2018
Wake – Johnston County Measles Case: June 2018

• Unvaccinated index case returned from vacation in France on 6/2/18
• Rash onset 6/10/18; infectious 6/6 to 6/14
• Exposed persons in 3 different healthcare settings on 5 separate visits from 4 other states and 15 counties
• Over 300 contacts investigated; 2 family members infected
• Genotype D8A; associated with outbreak strain in Europe
Health Care Settings

• Presumptive immunity
  – 2 valid doses MMR
  – Lab evidence of immunity or previous disease

• Furlough non-immune exposed staff
The Window: Incubation period 7 to 21 days, average 14 days

6/10 Rash onset

6/26 - End of incubation period for 6/6 exposures

7/4 - End of incubation period for 6/14 exposures

6/6 6/14

Infectious 4 days before & after rash onset

PEP-MMR within 3 days of exposure; IG within 6 days of exposure
§ 130A-145. Quarantine and isolation authority

- (a) The State Health Director and a local health director are empowered to exercise quarantine and isolation authority. Quarantine and isolation authority shall be exercised only when and so long as the public health is endangered, all other reasonable means for correcting the problem have been exhausted, and no less restrictive alternative exists.

§ 130A-25. Misdemeanor

- (b) A person convicted under this section for violation of G.S. 130A-145 shall not be sentenced under Article 81B of Chapter 15A of the General Statutes but shall instead be sentenced to a term of imprisonment of no more than two years...
3 Basic VPD Questions: ICE

1. Immune Status
   - Shot record, disease history?
   - Vaccine effectiveness
   - Waning immunity?

2. Clinical Presentation
   - Onset date of each symptom
   - Classic or modified presentation?
   - Lab results

3. Epidemiology
   - What is incubation period? Infectious period?
   - Demographics, travel, employment, activities, school, congregate settings
3 Basic Response Steps for Healthcare Settings

• **Screen**
  - Immune status
  - Clinical information
  - Epi, activities, travel, exposure history

• **Isolate**
  - Airborne precautions for measles
  - 2 hour timeframe even after patient leaves

• **Call public health immediately**
  - Assure control measures are initiated
  - Arrange for appropriate testing
  - Begin contact investigation
5 VPD Control Strategies for Public Health

1. Identify infection; manage case
2. Define population at risk
3. Manage non-immune exposed persons
   - Vaccinate?
   - Exclude?
4. Obtain appropriate clinical specimens
5. Maintain surveillance
Lessons learned

• Most clinicians have never seen a true case of measles
• Immune status, clinical presentation and epi (travel history) need to be assessed for every patient presenting in an urgent care setting
• Most adults do not have ready access to their shot records
• Unvaccinated returning travelers continue to be a source of measles spread in the U.S.