

Proposal for Conducting Sentinel Surveillance for Pulmonary Nontuberculous Mycobacteria (NTM) in Hennepin and Ramsey Counties under the Minnesota Communicable Disease Rule (4605.7046)

Division: Infectious Disease Epidemiology, Prevention and Control Division

Section: Healthcare-Associated Infections (HAI) and Antimicrobial Resistance (AR) Section

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Under part 4605.7046 of the Communicable Disease Reporting Rule, the Commissioner may select infectious diseases/syndromes and reporting sites for sentinel surveillance if the specified criteria are met. The law specifically says:

“Subpart 1. **Disease selection.** The commissioner may select an infectious disease or syndrome for sentinel surveillance, other than a disease or syndrome for which general reporting is required under this chapter, if the commissioner determines that sentinel surveillance will provide adequate data for epidemiological purposes and the surveillance is necessary for:

- A. characterization of the pathogen;
- B. monitoring vaccine effectiveness; or
- C. achieving other significant public health purposes for a disease or syndrome that can cause serious morbidity or mortality.

Subp. 2. **Site selection.** The commissioner shall select, after consultation with the sites, sentinel surveillance sites that have epidemiological significance to each disease or syndrome selected under subpart 1. In selecting the sites, the commissioner shall consider:

- A. the potential number of cases at the site;
- B. the geographic distribution of cases or potential cases in Minnesota, if indicated by the epidemiology of the disease or syndrome;
- C. the epidemiology of the disease or syndrome; and
- D. the overall impact of sentinel surveillance on a site and the benefit to public health in conducting sentinel surveillance at the site.”

1. DISEASE SELECTION

A. Will population-based sentinel surveillance provide adequate data for epidemiological purposes, specifically characterization of the pathogen or achieving other significant public health purposes for a disease or syndrome that can cause serious morbidity or mortality?

Nontuberculous mycobacteria (NTM) are opportunistic bacteria that are widespread and naturally occur in the environment, especially in soil and water.¹ The prevalence of human disease caused by pulmonary NTM infection and the deaths associated with NTM infection have increased over the last two decades. The reason for this is unknown.² Potable water systems are excellent reservoirs for NTM. In both hospitals and clinics, NTM infect patients, particularly if there are breaches in a patient's natural defenses, including medical devices. Healthcare-associated transmission has occurred due to contaminated medical equipment or solutions that contain water.³ NTM causes both pulmonary and extrapulmonary disease, depending on the body site of the infection. Pulmonary NTM infections, which occur in the lungs, result from inhalation of airborne particles containing the bacteria, and primarily cause infections in individuals with underlying lung disease. Pulmonary specimens include sputum samples, tracheal secretions, lung biopsies, and bronchoalveolar lavage. People who have an existing lung disease such as bronchiectasis (enlargement of the airways), chronic obstructive pulmonary disease (COPD), cystic fibrosis, alpha-1 antitrypsin deficiency, or prior infection with tuberculosis are at increased risk for pulmonary NTM infection. However, emerging data suggest that many persons without such existing conditions may be genetically susceptible to pulmonary NTM infection.⁴ Pulmonary NTM infection can present at any age but is most common in patients over 50 years of age.

Pulmonary NTM infection is of particular concern within the cystic fibrosis patient population. Large studies have estimated that the prevalence of pulmonary NTM among cystic fibrosis patients is between 6–13%.⁵ Person-to-person transmission of pulmonary NTM is rare; however, there have been reports of potential transmission of mycobacterium species in institutions caring for cystic fibrosis patients.^{6,7}

It is hypothesized that regulations to limit the water temperature in health care settings to prevent scalding hinder the control of NTM. Current data suggest that the frequency of healthcare-associated outbreaks due to NTM may be increasing. Reported healthcare-associated outbreaks of pulmonary NTM have been caused by numerous factors involved with patient care.⁸ These have included the water supply linked to a common patient shower, a contaminated hospital ice machine, a hydrotherapy pool in which children with cystic fibrosis were regular users, contaminated aqueous solution or contaminated potable water used in the processing of reusable dialysis filters, contaminated peritoneal dialysis machines, and contaminated bronchoscopes. A bronchoscope is an instrument inserted into the airway to allow a doctor to look at a patient's lungs. Bronchoscope suction valves and channels are difficult to clean and

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disinfect and they can become contaminated with NTM, which has led to the transmission of pulmonary NTM disease to previously uninfected patients.⁹

Symptoms of pulmonary NTM infection are similar to those of tuberculosis and include cough with sputum production, shortness of breath, tiredness or fatigue, fever, unplanned weight loss, lack of appetite, night sweats, and coughing up blood. Although the symptoms of pulmonary NTM can be debilitating, they are also non-specific and not immediately suggestive of pulmonary NTM. Diagnosis is often delayed because symptoms may appear to be a part of the existing lung disorder. As NTM are present in the environment the bacterium may possibly contaminate sputum specimens and may be present in the airways for a short period of time without causing infection. Precise clinical, microbiological, and radiological evidence of disease must be present before a diagnosis can be confirmed. Specifically, isolation of NTM from two sputum specimens or from a single bronchoalveolar lavage, or compatible histopathological features/isolation from a lung biopsy specimen is used for the diagnosis along with compatible clinical and radiographic findings.¹⁰

Treatment for pulmonary NTM is complex and involves potentially toxic and complicated antibiotic drug regimens. The goal of treatment is to improve the patient's symptoms and their long-term quality of life. Because most people who suffer from pulmonary NTM infection have an underlying lung condition, their underlying condition must also continue to be treated during their NTM treatment. Antibiotic therapy for pulmonary NTM infection is generally continued for at least 12 months after the disease is gone. Prolonged treatment regimens are required as relapse is very common.¹⁰

Almost 200 species of NTM have been identified, but less than 20 commonly cause human infections.¹¹ The incubation period of NTM infection varies depending on the mycobacterium species, exposure, and disease manifestations, and can extend from several weeks to possibly five years.¹² As treatment of NTM infections will be dependent on the species, cultured NTM specimens should be identified to the species level. NTM species are classified based on the speed of growth and presence of pigment on laboratory media.¹³ NTM commonly form biofilms, which are a thin film of bacteria that adhere to surfaces in the environment, and can be highly resistant to disinfectants.¹⁴ Strict infection control and prevention practices are critical to the control of NTM outbreaks. However, this can often be very difficult, given that NTM species can be found in the environment, and many standard infection control practices are not always effective against NTM.¹⁵

Hennepin and Ramsey counties are the two most populous counties in Minnesota and account for nearly 30% of the population in Minnesota. Included among the acute care hospitals in this region are transplant centers, children's hospitals, trauma centers, and a Veteran's Affairs hospital. These varied care levels and patient populations will allow for a surveillance area that is comprehensive, thorough, and will produce data to monitor pulmonary NTM trends and antibiotic resistance in NTM. We propose to conduct sentinel surveillance for five years. The surveillance will assess the burden of pulmonary NTM in Hennepin and Ramsey counties and allow MDH to better understand

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the epidemiology of pulmonary NTM and specific associated risks in Minnesota. A number of studies worldwide have described an increasing prevalence and incidence of pulmonary NTM in recent years. Sentinel surveillance in Ramsey and Hennepin counties will enable MDH to assess the burden of disease and trends, as well as identify potential outbreaks due to pulmonary NTM.

B. Why is the surveillance necessary?

MDH lacks a systematic method of collecting and studying the incidence and prevalence of pulmonary NTM and a means to track antibiotic resistance in NTM. Further, surveillance will enable the identification of possible outbreaks due to NTM and help MDH assess the burden of disease and trends in pulmonary NTM cases. The lack of surveillance impedes MDH's ability to monitor, prevent, and control pulmonary NTM and protect the health of Minnesota residents. As described above, pulmonary NTM can cause severe and debilitating infections that are difficult to diagnose and treat in susceptible populations. Sentinel surveillance will provide data for assessing the incidence and prevalence of pulmonary NTM, tracking any potential increase in pulmonary NTM cases, along with observing the types of infections and demographics and clinical characteristics of the patients and their outcomes.

Objectives of this sentinel surveillance:

1. Determine and monitor the incidence, prevalence, and burden of pulmonary NTM among Hennepin and Ramsey county residents.
2. Assess the risk factors for pulmonary NTM infection.
3. Describe the epidemiology of pulmonary NTM among residents of Hennepin and Ramsey counties, the two most populated counties in Minnesota, and assess any increase in cases, as seen in the national and global trends.
4. Identify and assess outbreaks of pulmonary NTM.

2. SITE SELECTION

A. Did you consult with the selected site(s)? Explain.

MDH contacted clinical and reference laboratories in Minnesota by email to introduce pulmonary NTM surveillance and request feedback about the proposed surveillance program. We described the justification for surveillance. We explained that MDH staff will perform chart reviews to complete case report forms. There were no issues or concerns raised by health care facilities or clinical laboratories.

B. Does the site(s) have epidemiological significance to the disease or syndrome selected? Explain.

Hennepin and Ramsey counties are the two most populated counties in Minnesota. In total, they comprise nearly 30% of the state's population. Nineteen acute care facilities providing varied levels of care operate within these two counties, including children's

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hospitals, long-term acute care hospitals, transplant centers, an academic facility, trauma centers, and a Veteran's Affairs hospital. In addition, there are many ambulatory care providers in these counties, including those specializing in pulmonary medicine and in infectious disease, and two centers that treat patients with cystic fibrosis.

C. Did you consider the following factors? Explain.

a. Potential number of cases at the site

The incidence of pulmonary NTM in these sites is not well known; this is part of what we will learn through this project. MDH collected de-identified line list data from the four major reference laboratories that conduct laboratory testing and identification of NTM for the state. From 2013 to 2017, an estimated 3,564 cases of pulmonary NTM were diagnosed in Minnesota residents. With Hennepin and Ramsey counties accounting for nearly 30% of the state's population it is estimated that approximately 200 cases of pulmonary NTM will be diagnosed per year among residents of Hennepin and Ramsey counties. However, as the data provided was de-identified we believe this number is an overestimate of the true disease burden of pulmonary NTM in Minnesota.

b. Geographical distribution of cases or potential cases in Minnesota, if indicated by the epidemiology of the disease or syndrome

A study from Oregon, one of the few states that does surveillance for NTM infections, found that pulmonary NTM infections were associated with more densely populated areas. As Ramsey and Hennepin counties are the two most populated counties in Minnesota, these counties may have a higher incidence than elsewhere in Minnesota.

c. Epidemiology of the disease or syndrome

Surveillance data from other U.S. regions along with worldwide data demonstrate that pulmonary NTM cases are increasing, but the specific cause is unknown. Pulmonary NTM presents with non-specific symptoms and is often difficult to diagnose. Infections are difficult to treat and require a prolonged course of antibiotics. Although some infections appear to be isolated, others are associated with common exposures, including health care procedures. In some situations, such as health care settings for patients with cystic fibrosis, there is even a risk of transmission of NTM from patient to patient. Many components of the epidemiology of NTM still need to be defined and understood, before effective prevention and control measures can be developed.

d. Overall impact of sentinel surveillance on a site and the benefit to public health in conducting sentinel surveillance at the site

Very little is known about the epidemiology of pulmonary NTM in Minnesota, and national data are limited as very few sentinel sites in the U.S. conduct surveillance. Establishing sentinel pulmonary NTM surveillance will allow MDH to estimate the pulmonary NTM burden and risk factors in residents of Hennepin and Ramsey counties, describe trends in the local epidemiology of pulmonary NTM, as well as provide insight into the epidemiology of this disease in Minnesota as a whole. MDH surveillance data will also contribute to an improved national understanding of the disease and regional comparisons of pulmonary NTM epidemiology. This surveillance will help Minnesota clinicians, infection preventionists and public health practitioners because local data on burden, trends and risk factors, and data on NTM species and their antibiotic susceptibilities can inform treatment, prevention, and control measures. We plan to conduct surveillance for a five-year period after which we will review the need for continued surveillance.

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