The purpose of this slide set is to characterize the epidemiology of tuberculosis (TB) disease in Minnesota. The slides describe both demographic and clinical characteristics of TB statewide. The data in these slides pertain to confirmed cases of active TB disease reported from 2011 through 2015. In accordance with the Minnesota Communicable Disease Reporting Rule, physicians, laboratories, and other health care providers are required to report all confirmed and probable cases of TB disease among persons residing in Minnesota to the Minnesota Department of Health; such reports serve as the source of information for the data presented in these slides.
In 2015, 150 new cases of active TB disease among residents of Minnesota were reported to the Minnesota Department of Health, comparable to the average number of cases over the past five years (149). This number corresponds to an incidence rate of 2.7 cases per 100,000 population. In comparison, 9,557 new cases of TB disease (3.0 cases per 100,000 population) were reported in the United States during 2015; the median TB incidence rate among 51 states and reporting areas nationally was 2.0 cases per 100,000 population. It was the first time since 1992 that TB case counts had increased in the U.S., although incidence has remained stable since 2013.

This slide also depicts the number of deaths attributed to TB in Minnesota between 2011 and 2015. Overall, 3% of TB cases died as a result of TB during this five-year period, ranging from 1% in 2013 and 2015 to 7% in 2011. (These data do not include individuals who died from causes other than TB.)
This slide depicts the incidence rate for TB in Minnesota and the United States from 2000 to 2015. The rate of TB in Minnesota has consistently been lower than the national rate, with the exception of one year (2007) when there were 4.6 cases/100,000 Minnesotans and 4.4/100,000 nationally. The rates of TB in Minnesota and nationally have not met the Healthy People 2010 and 2020 objective of 1.0 TB case per 100,000.
During the past decade, the percentage of non U.S.-born persons among TB cases reported in Minnesota has averaged 81%, ranging from 73% to 86%. The average non U.S.-born percentage during this time period among cases nationally was 62%. In 2015, 86% of TB cases in Minnesota were born outside the U.S., compared to 66% of TB cases reported nationally.
### Number of Cases and Incidence of Tuberculosis by Location of Residence, Minnesota, 2011-2015

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Hennepin County</td>
<td>59 (5.0)</td>
<td>71 (6.1)</td>
<td>51 (4.3)</td>
<td>51 (4.3)</td>
<td>57 (4.7)</td>
</tr>
<tr>
<td>Ramsey County</td>
<td>31 (6.0)</td>
<td>39 (7.6)</td>
<td>39 (7.5)</td>
<td>26 (4.9)</td>
<td>29 (5.4)</td>
</tr>
<tr>
<td>Suburban Twin Cities Metro†</td>
<td>12 (0.7)</td>
<td>27 (2.2)</td>
<td>20 (1.6)</td>
<td>24 (2.0)</td>
<td>25 (2.0)</td>
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<tr>
<td>Olmsted County</td>
<td>9 (6.2)</td>
<td>3 (2.1)</td>
<td>10 (6.8)</td>
<td>16 (10.7)</td>
<td>12 (8.0)</td>
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<tr>
<td>Other counties</td>
<td>26 (1.1)</td>
<td>22 (1.0)</td>
<td>31 (1.3)</td>
<td>30 (1.3)</td>
<td>27 (1.2)</td>
</tr>
<tr>
<td>Total</td>
<td>137 (2.6)</td>
<td>162 (3.0)</td>
<td>151 (2.8)</td>
<td>147 (2.7)</td>
<td>150 (2.7)</td>
</tr>
</tbody>
</table>

* Rate per 100,000 population. Rates were calculated using population estimates from U.S. Census Bureau data.

† Anoka, Carver, Dakota, Scott, and Washington counties

This slide presents the number and rate of new TB cases reported by county of residence in Minnesota from 2011 through 2015. County-specific data are presented for Hennepin, Ramsey, and Olmsted counties, which are the three counties in Minnesota that operate public TB clinics. The slide also presents data for the five-county suburban Twin Cities metropolitan area and for Greater Minnesota, excluding Olmsted County. Among the metro area counties, the highest TB incidence rate in 2015 was reported in Ramsey Country (5.4 cases per 100,000 population), followed by Hennepin County (4.7 cases per 100,000 population) and Dakota County (2.7 cases per 100,000 population).
This slide presents a map of Minnesota with counties shaded according to the number of TB cases reported in their jurisdictions during 2015. Although 23 (26%) of the state’s 87 counties reported at least one new case of TB disease in 2015, the majority of cases occurred in the Twin Cities metropolitan area. The largest number of cases occurred in Hennepin County (57, or 38%) and Ramsey County (29, or 19%). Over a quarter (26%) of the new TB cases in 2015 were reported by Greater Minnesota counties.
This slide presents data on TB cases, by county of residence, reported in Minnesota from 2011 through 2015. Similar to the previous slide, these data emphasize that the greatest burden of TB disease occurred primarily in certain areas of the state, although the geographic distribution of cases was more widespread. Of the state’s 87 counties, 43 (49%) reported at least one case of TB disease during this five-year period. Hennepin and Ramsey counties accounted for over 60% of all new TB cases reported during this time period, while 25% of cases were reported in Greater Minnesota.
The age distribution of TB cases reported in Minnesota differs markedly between U.S.-born and non U.S.-born patients. The largest group (43%) of non U.S.-born TB cases reported in Minnesota from 2011 to 2015 was between 25 to 44 years of age, whereas the number of U.S.-born cases was more evenly distributed, with the highest number in older age groups. These strikingly different age distributions reflect the differing risks of exposure to TB among these populations. For example, newly-arrived refugees and immigrants to Minnesota tend to be younger, and TB cases in these age groups likely were already infected with TB before arriving in the U.S. Among U.S.-born persons, adults who were born 50 or more years ago when TB was much more prevalent in Minnesota are more likely than younger U.S.-born persons to have been infected with TB. As these older U.S.-born persons age and develop other medical conditions that may weaken their immune systems, they may progress from latent TB infection to active TB disease.

The proportion of children under five years of age was much higher among U.S.-born TB cases reported in Minnesota from 2011 through 2015 than among non U.S.-born cases (14% versus <1%, respectively). Eighty-four percent of these young U.S.-born cases had at least one non U.S.-born parent or guardian. These second-generation children appear to experience an increased risk of TB disease that more closely resembles that of non U.S.-born persons. These children were likely exposed to TB as a result of travel to their parents’ country of origin or from family members with active disease.
This slide presents data on TB cases, by sex at birth, reported in Minnesota from 2011 through 2015. Slightly more males than females were represented among TB cases reported statewide (54% to 46%), which is typical of TB cases reported in the United States. Among the U.S.-born TB cases, the difference in sex at birth was more pronounced (62% males to 38% females). Among non U.S.-born TB cases, the distribution of sex at birth was relatively equal (52% males to 48% females). The difference in TB rates by sex at birth could be due to the unequal distribution of TB risk factors among U.S.-born cases.
This slide depicts the incidence rate of TB disease by race/ethnicity in Minnesota from 2011 through 2015. Non-white racial and ethnic populations in Minnesota are disproportionately affected by TB. In particular, the incidence rate of TB disease reported in 2015 was highest among Africans or African-Americans (24.5 cases per 100,000 population), followed by Asians or Pacific Islanders (15.3 cases per 100,000 population). In comparison, the TB case rate among non-Hispanic whites was 0.3 cases per 100,000 population. The TB incidence rates among American Indians/Alaska Natives and Hispanics/Latinos in 2015 were 6.0 and 3.2, respectively. During this five-year period, TB rates were generally highest among Africans or African-Americans and among Asians or Pacific Islanders.
The racial and ethnic distribution of TB cases reported in Minnesota from 2011 through 2015 differed between non U.S.-born and U.S.-born populations. Among non U.S.-born cases, the majority (54%) were black, 35% were Asian, 9% were Hispanic or Latino, 3% were white, and one case was Native Hawaiian or Pacific Islander. Among the much smaller number of U.S.-born TB cases, the largest proportion (43%) were white, 24% were black, 13% were American Indian or Alaska Native, 10% were Hispanic or Latino, 9% were Asian, and one case was reported as multi-racial. Regardless of place of birth, non-white racial and ethnic populations were disproportionately affected by TB, comprising larger proportions among TB cases than their proportional representation in the overall state population.
Among African or African-American TB cases reported in Minnesota from 2011 to 2015, the vast majority (91%) were born outside the U.S. The largest group of black cases were persons born in Somalia (47%) and Ethiopia (22%). Among the remaining non U.S.-born persons accounting for at least 5% of all black cases, 7% were from Kenya and 6% from Liberia.
Co-infection with HIV is the most significant medical risk factor for progression from latent TB infection to active TB disease. It is estimated that individuals infected with both TB and HIV have up to a 10% annual risk of developing active TB disease, compared to a 5-10% lifetime risk for those with latent TB infection in general. For this reason, TB diagnostic and treatment guidelines recommend that patients with active TB disease receive HIV testing at the time of diagnosis, unless they already are known to be HIV-positive.

This slide presents TB cases reported in Minnesota from 2011 through 2015 by HIV status and place of birth. During this time period, 94% of TB cases in Minnesota were tested for HIV. Three percent tested positive for HIV. The prevalence of HIV co-infection among U.S.-born TB cases was less than that of non U.S.-born TB cases (1% versus 4%, respectively).

The proportion of TB cases who were not offered HIV testing was higher for U.S.-born than for non U.S.-born individuals (9% versus 4%), although it is recommended for all TB cases. A very small proportion (<1%) of TB cases declined HIV testing. Of those not screened for HIV, the majority (89%) were not offered the test.
The right side of this slide gives the number of TB cases co-infected with HIV in the past 10 years in Minnesota, ranging from a high of 12 cases in 2007 to a low of 3 cases in 2011. There were nine TB-HIV cases reported in 2015 in Minnesota.

The TB-HIV co-infection rate is generally lower in Minnesota compared to the national rate, with the exception of 2015. On average, 4% of all Minnesota TB cases were co-infected with HIV in the past decade. In comparison, an average of 8% of all TB cases in the US since 2006 were also infected with HIV.
It is critical that all TB patients with an unknown HIV status be screened, since the TB treatment regimen for individuals who are co-infected with HIV is more complex. Starting in 2010, the focus of the national objective for HIV testing of TB cases shifted from those in the 25-44 age group to all age groups. Since this change, the percentage of Minnesota TB cases with a known HIV status has consistently been high, on average over 95%. Conversely, it is also critical that HIV-infected patients be screened for latent TB infection (LTBI), as these individuals are a high priority group for LTBI treatment.
The distribution of risk factors for TB infection and progression to active disease differs greatly by place of birth. Among TB cases reported in Minnesota from 2011 and 2015, patients born in the U.S. were more likely to have been a contact to an infectious TB patient within the past 2 years, have a history of substance abuse or experience homelessness within the year prior to TB diagnosis, and reside in a long-term care facility or correctional facility at the time of diagnosis. Non U.S.-born cases, on the other hand, were more likely to have worked in a healthcare setting in the year preceding their diagnosis, and also more likely to be co-infected with HIV.

TB patients born in the U.S. were more likely to report having a medical risk factor for progression to active TB disease (excluding HIV/AIDS): 27% of U.S.-born TB cases compared to 20% of non U.S.-born cases. Among U.S.-born cases, the most commonly reported medical risk factor was having an immunosuppressive condition (not HIV/AIDS) or being on immunosuppressive therapy, accounting for 16% of these patients. The second most commonly reported medical condition among U.S.-born patients was diabetes, accounting for 12% of these patients. Among non U.S.-born patients, diabetes was the most commonly reported condition, accounting for 11% of non U.S.-born patients. Seven percent of non U.S.-born patients reported immunosuppression (not including HIV/AIDS).
Certain medical conditions, other than HIV/AIDS, increase the risk that latent TB infection will progress to active TB disease. Of the 747 TB cases reported in Minnesota during 2011-2015, 21% reported at least one of these co-morbidities. Eleven percent were reported as having diabetes and 9% reported having an immunosuppressive condition or were on immunosuppressive therapy at the time of the TB diagnosis. End stage renal disease was reported by 3% of TB cases. Persons who were underweight or malnourished accounted for 1% of cases. Hematologic/reticuloendothelial disease or silicosis was present in less than 1% of TB cases. This slide illustrates that screening for tuberculosis (and treatment for latent TB infection, if indicated) should be routinely considered for individuals with these medical conditions.
Among TB cases reported in Minnesota from 2011 to 2015, 22% occurred among students or individuals attending daycare. Ten percent of TB cases attended preschool, elementary or secondary school and 7% reported post-secondary education at time of diagnosis. An additional 6% reported some other schooling (such as ESL classes) or daycare (child or adult) attendance.

<table>
<thead>
<tr>
<th>School/Setting</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preschool</td>
<td>2 (&lt;1)</td>
</tr>
<tr>
<td>Elementary</td>
<td>39 (5)</td>
</tr>
<tr>
<td>Secondary</td>
<td>32 (4)</td>
</tr>
<tr>
<td>Post-secondary</td>
<td>51 (7)</td>
</tr>
<tr>
<td>Other*</td>
<td>44 (6)</td>
</tr>
<tr>
<td>None</td>
<td>578 (77)</td>
</tr>
<tr>
<td>Unknown</td>
<td>1 (&lt;1)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>747 (100)</strong></td>
</tr>
</tbody>
</table>

*includes: adult or child daycare, ESL/ELL, and other schools
This slide depicts the number of TB cases reported in Minnesota from 2011 through 2015 by region of birth and year of diagnosis. The trends seen in this slide are influenced by both the global incidence of TB in specific regions worldwide and also by the changing trends and demographics of immigration to Minnesota. Over the past five years, the number of TB cases reported in Minnesota has been highest among persons originating from sub-Saharan Africa, a region of the world where TB is common. Minnesota is also home to a large population of persons born in South/Southeast Asia, another TB endemic area. The annual number of TB cases reported among this population has been relatively stable over the past five years.
NOTE: THIS SLIDE PRESENTS SIMILAR DATA TO THE PRIOR SLIDE, BUT GROUPED BY REGION OF THE WORLD.

This slide depicts the number of TB cases reported in Minnesota from 2011 through 2015 by region of birth and year of diagnosis. The trends seen in this slide are influenced by both the global incidence of TB in specific regions worldwide and also by the changing trends and demographics of immigration to Minnesota. Over the past five years, the number of TB cases reported in Minnesota has been highest among persons originating from sub-Saharan Africa, a region of the world where TB is common. Minnesota is also home to a large population of persons born in South/Southeast Asia, another TB endemic area. The annual number of TB cases reported among this population has been relatively stable over the past five years.
Among non U.S.-born TB cases reported in Minnesota from 2011 through 2015, the largest percentage (28%) were born in Somalia. Other countries of birth that represented at least 4% of cases each included Ethiopia, Laos, Viet Nam, Mexico, India, and Kenya. Patients from a geographically and ethnically diverse group of 45 other countries comprised the remaining 31% of non U.S.-born TB cases reported during this period. The ethnic diversity among non U.S.-born TB cases in Minnesota poses challenges for those providing TB prevention, treatment, and control services that are appropriate for persons from such a wide array of cultural, linguistic, and socio-economic backgrounds.
Persons arriving as refugees or immigrants seeking permanent residence in the United States are screened prior to immigration for conditions of public health significance, including communicable diseases such as pulmonary TB disease. (It is also recommended that all refugees be screened again within three months of their arrival in the U.S.) Forty-eight percent of the non U.S.-born TB cases reported in Minnesota from 2011 through 2015 initially arrived in the U.S. as refugees, and another 29% arrived as immigrants. Nineteen percent of non U.S.-born TB cases arrived with other non-immigrant visa classifications, including visitors, tourists, students, and those with employment visas; TB screening prior to U.S. arrival is not required for these persons. Visa status was unknown for 4% of non U.S.-born TB cases.
Eighteen percent of non U.S.-born TB cases reported in Minnesota from 2011 to 2015 had resided in the United States for less than one year when they were diagnosed with TB disease. These patients most likely represent persons who acquired latent TB infection outside the U.S. and began progressing to active TB disease prior to or soon after arriving in the U.S. Although many such cases may not be preventable in the U.S., there is additional TB screening required for a number of new arrivals to promptly diagnose active disease and initiate treatment. This screening will be further described in a later slide.

Most of the non U.S.-born TB patients developed active disease after living in the U.S. for a number of years. Over 50% of non U.S.-born TB cases reported in Minnesota from 2011-2015 had been in the U.S. for six years or longer prior to being diagnosed with TB disease, the majority developing active disease at least 10 years after arrival. Many of these patients reported advanced age and co-morbidities increasing the likelihood of progressing to active TB disease. These data show the importance of thorough domestic screening of recent arrivals as well as evaluation and treatment of latent TB infection among older populations with co-morbidities.
Since the implementation of revised technical instructions for pre-immigration medical examinations in 2007 to further reduce the burden of TB in the U.S., there has been an overall decrease in the percentage of non U.S.-born cases diagnosed within the first year after U.S. arrival (average since 2007: 18%). There has been a corresponding increase in the percentage of non U.S.-born cases diagnosed more than five years after arrival (average since 2007: 49%). In 2015, 19% of non U.S.-born cases to MN were diagnosed within the first year, while 53% were diagnosed more than five years after arrival.
As mentioned in a previous slide, immigrants and refugees undergo medical evaluation, including TB screening, prior to coming to the United States. Individuals with TB-related conditions identified overseas are assigned a TB Class designation, ranging from Class A, which indicates active and potentially infectious TB disease, to Class B1, which indicates active, non-infectious TB, to Class B2, which indicates latent TB infection. For immigrants and refugees with a TB Class condition, the U.S. Centers for Disease Control and Prevention (CDC) notifies the state public health department where the patient is expected to arrive. State and local public health professionals in Minnesota collaborate to ensure that these individuals are referred to a local health care provider for comprehensive TB evaluation and treatment, as indicated.

Among new refugees and immigrants who were diagnosed with TB disease in Minnesota from 2011 to 2015 within one year after their arrival in the U.S., only 28% had a TB Class designation assigned overseas, while 31% had documented overseas screening results showing no indication of a TB Class condition. The results of the overseas medical evaluations were unknown for 41% of these non U.S.-born TB cases. These patients included persons who initially resettled in another U.S. state and whose overseas screening results were not available to the Minnesota Department of Health. These findings strongly suggest that clinicians cannot rely solely on the results of pre-immigration medical examinations performed overseas to identify TB disease among non U.S.-born persons. Clinicians should have a high index of suspicion for TB in any non U.S.-born patient from TB endemic areas who presents with signs or symptoms consistent with active TB disease.
Tuberculosis disease most commonly affects the lungs, although it can affect almost any site in the body. Over half of the cases reported from 2011 to 2015 had TB disease exclusively in the lungs, and another 12% had TB in both pulmonary and extrapulmonary sites. TB was found exclusively in extrapulmonary sites in 36% of cases. In comparison, 70% of all TB cases reported nationally in 2015 were exclusively pulmonary, 20% exclusively extrapulmonary, and 10% had TB in both sites.
Extrapulmonary TB occurs more frequently among non U.S.-born persons than among U.S.-born TB cases. Consequently, due to the large proportion of TB cases in Minnesota that occur among non U.S.-born persons, extrapulmonary TB is more common in Minnesota than nationally (48% of Minnesota cases from 2011-2015 compared to only 30% of U.S. cases in 2015). More than half (51%) of non U.S.-born TB cases reported in Minnesota from 2011 through 2015 had an extrapulmonary site of disease, as compared to only 29% of U.S.-born cases. This slide illustrates the need, especially in Minnesota, for clinicians to have a high index of suspicion for TB particularly for non U.S.-born patients, even when the patient does not present with a cough or abnormal chest radiograph or other common signs and symptoms of pulmonary TB.
Among extrapulmonary TB cases reported in Minnesota from 2011 through 2015, over half (54%) had lymphatic disease. Musculoskeletal (includes the bone/joint and any surrounding muscles or tissues), pleural, and peritoneal TB affected 18%, 10%, and 5% of extrapulmonary TB cases, respectively. Four percent of extrapulmonary cases had genitourinary TB, and 3% each had TB in the brain or a meningeal site of disease. Thirty-six (10%) cases had other extrapulmonary sites of disease that did not fall into any of the previous categories. Note that a person can have more than one extrapulmonary site of disease.
A posterior-anterior radiograph of the chest is one of the primary diagnostic tests performed to detect abnormalities suggestive of active pulmonary TB disease. In pulmonary TB, chest x-ray abnormalities often are seen in the apical and posterior upper lobes of the lungs or in the superior segments of the lower lobes. Cavitary lesions are indicative of severe or advanced disease and increase the likelihood of infectiousness in TB patients. In TB patients who are very young or who are co-infected with HIV, pulmonary TB may present with atypical, or even normal radiographic findings.

Among 480 pulmonary TB cases reported in Minnesota from 2011 through 2015, the vast majority (99%) had findings from chest imaging (chest x-ray or chest CT scan) consistent with TB disease, including 148 (31%) patients with cavitary lesions. Around 1% of pulmonary TB cases had chest imaging results that were normal or not consistent with TB disease.
Persons with pulmonary or laryngeal TB disease may be infectious or able to transmit TB to others. Except for very unusual circumstances, extrapulmonary TB disease is not infectious. The detection of acid-fast bacilli (AFB) in smears of sputum specimens obtained from a patient with pulmonary TB disease is one indicator of the patient’s level of infectiousness. Patients with positive AFB smears from sputum are considered potentially infectious. Although transmission of TB bacteria from sputum AFB smear-negative patients has been documented, such patients are less likely than sputum AFB smear-positive patients to be infectious.

Among 480 patients with pulmonary TB disease reported in Minnesota from 2011 through 2015, 37% had at least one initial sputum specimen with an AFB-positive smear result while half had all initial negative AFB smears. These data suggest that close to 40% of pulmonary TB cases in Minnesota likely are infectious and have the potential to spread TB to others prior to receiving several weeks of adequate treatment for TB disease. Thirteen percent had no initial sputum smear result reported. The majority (51%) of these pulmonary patients without sputum smear results were children under the age of 15 years; this reflects the difficulty in obtaining sputum specimens for laboratory confirmation in many pediatric cases. Gastric aspirates are usually recommended for young children.
Identification of *Mycobacterium tuberculosis* (or related species known to cause active disease) grown in culture from a clinical specimen is the “gold standard” for definitive diagnosis of TB disease, although the national surveillance case definition also allows cases to be counted on the basis of other criteria, which will be described in the next slide.

Culture confirmation of TB disease is critically important for the clinical management of TB cases, because most drug susceptibility testing is performed on isolates grown in culture. Also, for pulmonary TB cases, documentation of the conversion of a sputum culture result from an initially positive culture to a negative culture is an important marker of successful response to TB treatment.

Seventy-five percent of TB cases reported in Minnesota from 2011 through 2015 were confirmed by the identification of *M. tuberculosis* complex from culture. Initial mycobacterial culture was not performed or culture results were not reported for only 4% of cases.
This slide shows the proportions of TB cases reported in Minnesota from 2011 through 2015 who met the various hierarchical levels of the national surveillance case definition for reportable TB disease. Over 75% of Minnesota’s TB cases were laboratory-confirmed: counted on the basis of a culture that was positive for *Mycobacterium tuberculosis* complex, or less commonly, a positive nucleic acid amplification test for TB, or demonstration of acid-fast bacilli when cultures could not be done. Lab tests were either negative for *M. tuberculosis* complex or not done in the remaining 23% of cases. Most of those patients (20% of all cases) met the clinical component of the national TB case definition: they had a positive tuberculin skin test (TST) or positive interferon gamma release assay, or IGRA (TB blood test), but no laboratory confirmation of TB. Very few (3%) cases met neither the laboratory nor the clinical case criteria and, therefore, were counted solely on the basis of a provider diagnosis.
Drug-resistant TB is a serious public health concern globally, nationally, and in Minnesota. This slide presents drug susceptibility data among culture-confirmed TB cases reported in Minnesota from 2011 through 2015. Drug susceptibility testing is performed on all culture-confirmed TB cases reported in Minnesota unless an isolate is unavailable for testing. Among culture-confirmed TB cases, 21% were resistant to at least one first-line anti-TB medication [i.e., isoniazid (INH), rifampin (RIF), pyrazinamide (PZA), or ethambutol (EMB)]. This includes 12% of cases who were resistant to at least INH and almost 1% who were multidrug-resistant, which is defined as resistance to at least INH and rifampin, two of the most effective TB medications. There were no cases in this time period with extensively drug-resistant TB (XDR-TB), which is a type of MDR-TB with additional resistance to any fluoroquinolone and at least one of three injectable second-line medications.
Among culture-confirmed TB cases reported in Minnesota from 2011 through 2015, non U.S.-born cases were approximately 1.6 times more likely than U.S.-born cases to be resistant to any first-line anti-TB drug and 1.3 times more likely than U.S.-born cases to be resistant to isoniazid (INH), in particular. The rates of multidrug-resistant TB, or MDR-TB, were relatively similar among non U.S.-born and U.S.-born cases in Minnesota (0.8% and 1%, respectively).

<table>
<thead>
<tr>
<th>Place of birth</th>
<th>Cases With Susceptibility Results*</th>
<th>Any Drug Resistance† No. (%)</th>
<th>INH-Resistant** No. (%)</th>
<th>MDR-TB‡ No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non U.S.-Born Cases</td>
<td>473</td>
<td>107 (23)</td>
<td>57 (12)</td>
<td>4 (0.8)</td>
</tr>
<tr>
<td>U.S.-Born Cases</td>
<td>85</td>
<td>12 (14)</td>
<td>8 (9)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Total</td>
<td>558</td>
<td>119 (21)</td>
<td>65 (12)</td>
<td>5 (0.9)</td>
</tr>
</tbody>
</table>

* Culture-confirmed cases with drug susceptibility results available
† Resistance to at least one first-line anti-TB drug [i.e., isoniazid (INH), rifampin, pyrazinamide (PZA), or ethambutol]
** INH-resistant cases may also be resistant to other drugs
‡ Multi-drug resistant TB, defined as resistance to at least INH and rifampin
While the vast majority (81%) of TB cases reported in Minnesota from 2011 through 2015 were identified as a result of patients presenting at clinics or hospitals with symptoms of TB disease, a number of cases were identified from TB screening or other active case finding methods. Four percent of TB cases were found as a result of contact investigations conducted by local health departments surrounding individuals with infectious TB. Three percent were identified through the domestic health assessment recommended for all refugees within three months of their arrival in the U.S., and another 2% were identified during follow-up evaluations of newly-arrived immigrants and refugees designated as having a TB Class condition (such as an abnormal chest x-ray and/or positive sputum smear) during a required medical examination performed prior to immigration. Other immigration exams (such as change of status exams) accounted for 1% of TB cases. A total of 4% of TB cases reported during this time period were identified as a result of laboratory or radiologic tests performed for reasons other than suspected TB disease. The remaining 5% of cases were identified through other targeted testing, including employment-related TB screening.
The last four slides present data on the treatment and clinical management of TB cases in Minnesota.

This slide presents the mode by which TB treatment was administered for TB cases reported in Minnesota from 2011 through 2015. On average, over 99% of cases received at least some portion of their TB medication through Directly Observed Therapy (DOT). DOT, which involves having a health care provider or trained outreach worker observe a TB patient taking each dose of TB medications, is the recommended standard of care for the treatment of TB disease. During this five-year period, at most only 2% of TB cases reported each year self-administered their entire course of TB treatment. The widespread use of DOT in Minnesota is facilitated by the work of the local and tribal public health nurses in each county who are primarily responsible for administering DOT for TB cases in their jurisdictions.
The use of Directly Observed Therapy (DOT) is considered the standard of care for the treatment of TB disease. Local and tribal public health departments throughout Minnesota provide DOT at no cost, regardless of whether the patient is being treated by a private or public provider. This slide illustrates that, among TB cases reported in Minnesota from 2011 through 2015, the use of DOT was more common among patients who received treatment for TB disease at public health clinics than among patients who received TB treatment from private clinicians. Treatment for 2.4% of TB cases treated by private providers was exclusively self-administered, whereas no TB cases treated at public TB clinics received self-administered therapy exclusively.
This slide presents the outcome of treatment for the TB cases reported in Minnesota from 2010 to 2014 for whom 12 months or less of treatment was indicated. (2014 is the most recent annual cohort of patients for whom data on treatment outcome is complete.) This slide excludes patients with rifampin-resistant or meningeal TB, TB in the bone or central nervous system, and pediatric patients with disseminated TB, all of whom require a longer course of treatment. It also excludes patients who died or moved outside of the U.S. within one year of starting treatment. While most uncomplicated cases of TB disease are eligible for 6-9 months of treatment, the Centers for Disease Control and Prevention (CDC) has established an objective of 95% of TB cases completing adequate therapy within 12 months, which allows a margin of error for the often unavoidable obstacles that can prolong therapy.

These data indicate that the majority (94%) of eligible TB cases reported in Minnesota from 2010 to 2014 successfully completed an adequate course of treatment within one year, just below the CDC objective for 2020. When looking at whether these eligible cases have ever completed a full course of TB treatment, regardless of duration, the proportion increases to 98%.
The three TB public health clinics in Minnesota that manage patients with active TB disease are located in Hennepin, Ramsey and Olmsted counties. From 2011 to 2015, an average of 59% of all TB patients were followed by at least one of these public providers at some point in their disease course, while 41% were followed solely by private clinics or hospitals, or, less commonly, by Veteran Administration hospitals, correctional facility medical staff, or Indian Health Service. In 2015, the percentages were 56% and 44%, respectively.