

Tuberculosis in Colorado 2020

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COLORADO
Department of Public
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colorado.gov/cdphe/tb

Summary

In Colorado, 52 people were diagnosed with tuberculosis (TB) disease in 2020, a decrease of 21% from the 66 reported in 2019 (Figure 1 and Table 1). The Colorado case rate declined to 0.9 per 100,000 people (the lowest rate on record) from 2019's rate of 1.1 per 100,000 people. Similarly, the number of reported cases in the U.S. in 2020 decreased 20% from 2019. The U.S. case rate was 2.2 per 100,000 people according to the Centers for Disease Control and Prevention (CDC), [March 2020 TB report](#) (Figure 2). There are several factors that have contributed to the decline including an under- or misdiagnosis of TB due to the SARS-CoV-2 (COVID-19), individuals delaying care, a decline in travel to and from endemic areas in 2020, and the employment of successful mitigation strategies to slow the spread of COVID-19 such as masking and social distancing. Although the number of new TB patients in Colorado has fluctuated over the past 10 years, incidence of TB disease has declined approximately 62% from 2001, when there were 138 cases diagnosed the highest annual incidence in the past 25 years.

Fourteen (22%) of the state's 64 counties reported at least one person with TB disease in 2020. There were 11 new patients reported in Denver County, the most of any single Colorado county, followed by Arapahoe County with nine and El Paso County with eight. Sixty-three percent of all TB patients were reported in the Denver metro area (defined as Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, and Jefferson counties). Half (50%) of Colorado's counties (32 of 64) have reported at least one new TB patient in the past 10 years (2011-2020) (Table 1).

In 2020, TB disease burden in Colorado remained highest among racial and ethnic minorities (Figure 4), which is consistent with national epidemiologic trends. Though comprising only 32% of the state's population, 92% of new TB patients identified as racial and ethnic minorities. Having a diabetes diagnosis is the strongest medical risk factor for developing TB disease (17% of all patients in 2020). In addition, birth in one of the [30 countries with highest TB burden](#), as defined by the World Health Organization, remains a strong non-medical risk factor, comprising 27% of all patients in 2020 (Table 2 and Figure 11).

In 2020, TB disease was reported among people ranging in age from under-1 to 90 years, with an average age of 45 years (Figure 7). The largest number of cases were reported in the 25-44 years old with 15 cases, followed closely by those 45-64 with 14 cases, and then 65 and older age groups with 12 cases. There were five cases diagnosed in the under-15-year age group. TB disease in children is particularly concerning because it indicates ongoing transmission in the community as well as evidence of missed opportunities for prevention. Thirty-eight percent of new TB patients were female, and 62% were male (Figure 8). In 2019, by comparison, 58% of the patients were female.

Drug susceptibility testing is recommended for all culture-positive TB patients in the U.S. In 2020, 35 patients were culture-positive for TB and of those 34 had drug susceptibility results. Four (11%) of the 34 patients were resistant to one or more first-line TB drugs (isoniazid-INH, rifampin-RIF, pyrazinamide-PZA, ethambutol-EMB).

There was no multi-drug resistant (MDR) TB (defined as being resistant to at least INH and RIF), or extensively drug resistant (XDR) TB (defined as being resistant to isoniazid and rifampin, plus any fluoroquinolone and at least one of three injectable second-line drugs [i.e., amikacin, kanamycin, or capreomycin]) identified in 2020 (Figure 13).

TB drug treatment is lengthy, so completion rates are pending for 2020. Of the 66 TB patients reported in 2019, the most recent year with final completion data, 64 initiated treatment (two patients were dead at diagnosis). Sixty-one (95%) completed treatment and three died during treatment (Figure 15 and Figure 16). All new patients reported in 2020 initiated treatment.

Except for 2017, which was an outlier, TB disease, incidence remained steady over the past five years in Colorado. The state's 10-year TB Elimination Plan guides and informs programming to support people and populations at increased risk for developing TB disease as well as offering guidance to medical providers who care for those higher-risk populations. A key goal of the plan is to encourage people at risk to “know their TB status” while increasing public and private provider capacity to screen, test, and treat for TB infection. Untreated or incomplete TB infection treatment is the main driver of TB disease in Colorado.

The key path to TB elimination in Colorado remains identifying and treating people with TB infection who are at elevated risk of developing TB disease. Timely evaluation of people identified as contacts to an infectious TB patient and those who arrive in Colorado with a Class B TB designation (defined as having evidence of non-infectious TB but in need of additional evaluation) will drive the identification and treatment of additional patients with TB disease and TB infection. The Colorado Department of Public Health and Environment acknowledges that generations-long social, economic, and environmental inequities have resulted in adverse health outcomes including TB infection and disease among racial and ethnic minorities and others experiencing deficits in key social determinants of health. The COVID-19 pandemic magnified these inequities. While communities and individuals were differently, there is little doubt that both TB and COVID-19 disproportionately affected underserved people in under-sourced areas. CDPHE acknowledges that historic and systemic health inequities have a greater influence on health outcomes than either individual choices or a person's ability to access health care. Reducing the health disparities that can lead to TB infection and TB disease through policies, practices and organizational systems can help improve opportunities and health outcomes for all Coloradans.

The TB elimination plan is available on the TB Program website at <https://www.colorado.gov/pacific/cdphe/tb>.

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On the cover: Viewed using both epi-, and transmitted illumination, this magnified enlargement of a Petri dish culture plate, revealed the development of three differing colonial morphologies exhibited by *Mycobacterium tuberculosis* bacteria, cultivated on Middlebrook 7H10 agar growth medium. These organisms were members of Group III, nonphotochromogens, which meant that they exhibited only a pale yellow, buff, or tan pigment. Image courtesy of CDC’s Public Health Image Library.

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TB Cases and Rates

In 2020, 52 people were diagnosed and reported with tuberculosis disease (TB) in Colorado, a decrease of 21% from 2019. There are several factors that likely contributed to the decline; under- or misdiagnosis due to the COVID-19, individuals delaying care, decline in travel in 2020, and successful mitigation strategies meant to slow the spread of COVID-19 such as masking and social distancing. Although the number of patients has declined between 2006 and 2020, the decline has leveled off since 2012. Further progress towards the CDC TB elimination goal of 1 case per million (which would equate to ~5-6 cases per year) in Colorado will require refocused attention to the current public health TB prevention and control model in a post-pandemic world. Additionally new investment in progressive interventions as well as expansion to and collaboration with private health care partners who serve at-risk patients will be necessary to reach TB elimination. Overall, the number of patients and corresponding case rates are trending down in Colorado as the linear trend lines in Figures 1 and 2 illustrate.

Figure 1. Number of TB patients and trend line: Colorado 2001-2020

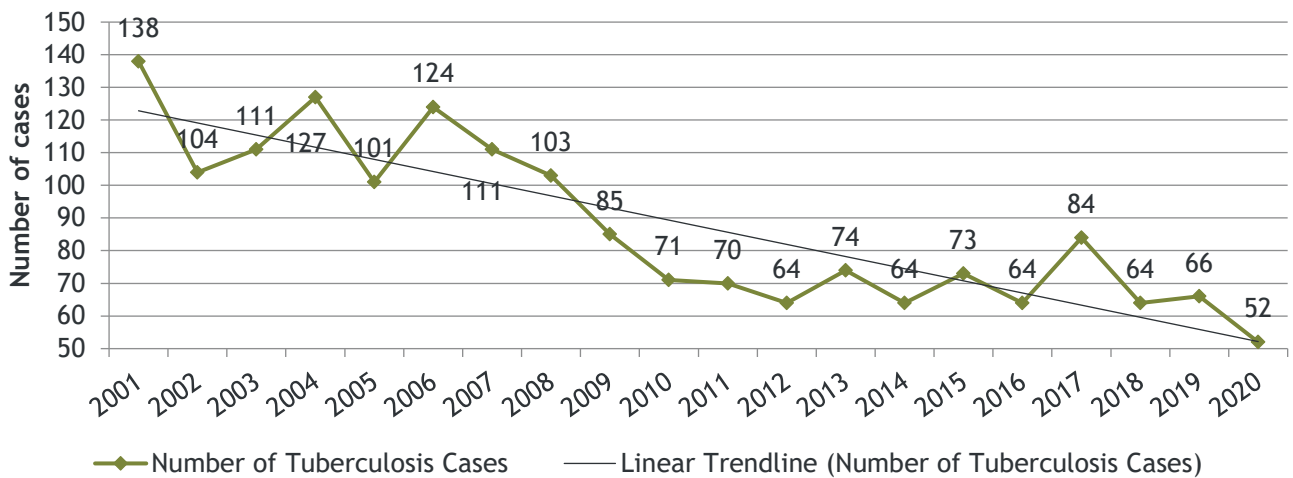
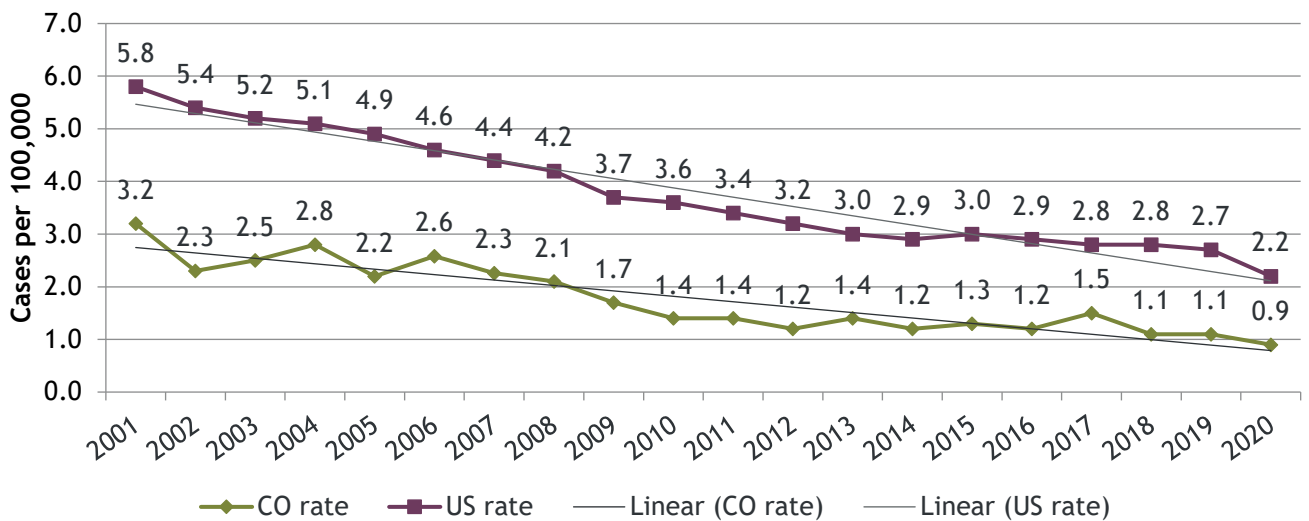


Figure 2. TB case rates per 100,000 people in the U.S. and Colorado 2001-2020



TB by County and Demographic Characteristics

Fourteen of Colorado's 64 counties reported at least one new person with TB disease in 2020. Denver County reported 11; followed by Arapahoe (9), El Paso (8), and Adams (7) counties (Figure 3). Thirty-two of Colorado's 64 counties have reported at least one new TB patient in the past ten years (Table 1). Table 2 offers a comparison between the demographics of 2019 and 2020 TB patients.

Figure 3. Tuberculosis Patients by County: Colorado 2020

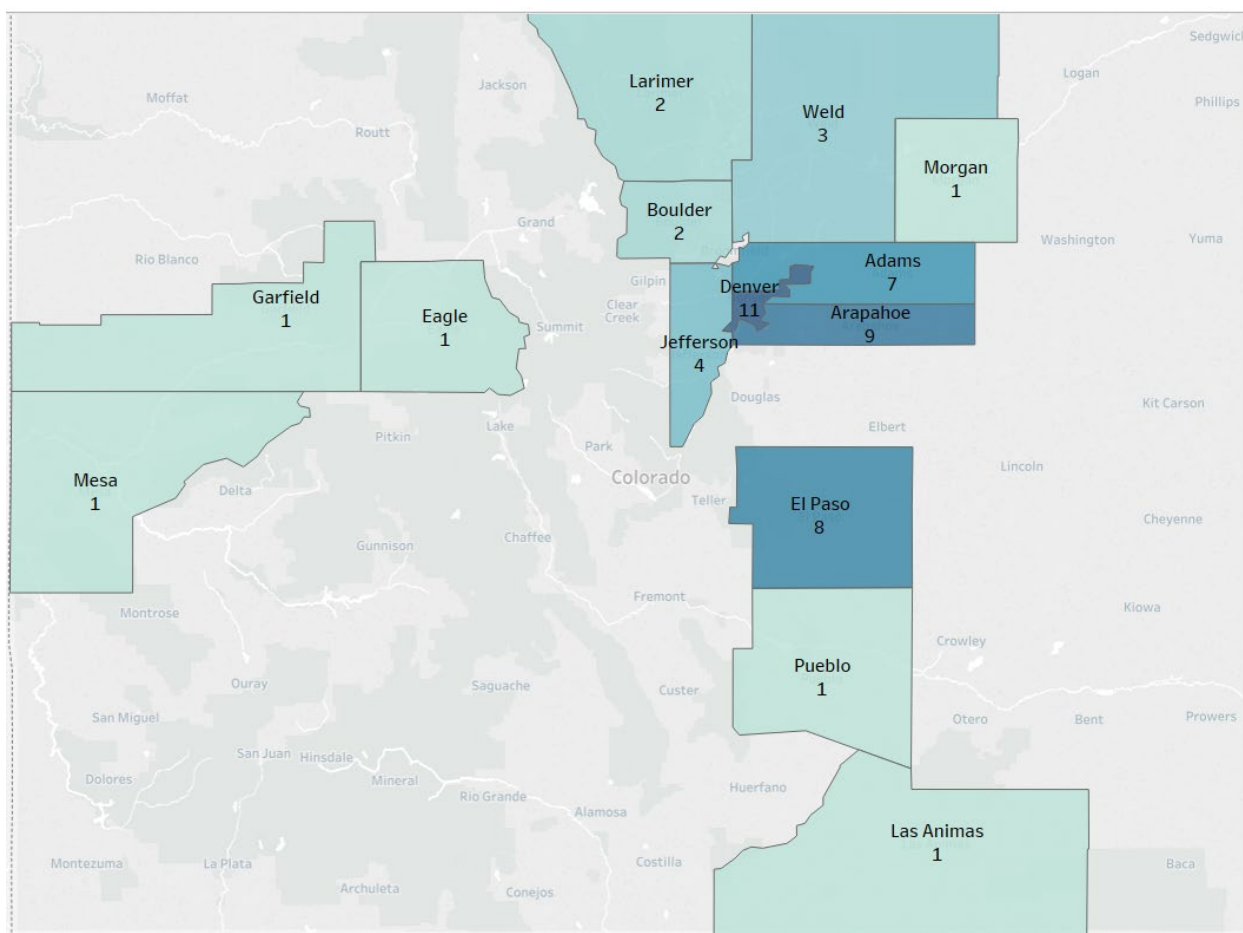


Table 1. TB in Colorado: Patients by County and Year of Report 2011-2020

County ^a	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020 ^b	5-Year Case Rate 2016-2020 ^{cd}
Adams	12	7	7	7	7	4	6	12	9	7	1.5
Arapahoe	5	11	14	14	14	18	19	10	18	9	2.3
Archuleta	0	0	1	0	0	0	0	0	0	0	n/a
Baca	0	0	1	0	0	0	0	0	0	0	n/a
Boulder	5	9	6	3	5	0	5	5	1	2	0.8
Broomfield	0	0	1	0	1	0	0	0	0	0	n/a
Denver	21	10	21	23	17	22	25	14	19	11	2.5
Douglas	2	1	2	1	8	1	0	3	2	0	0.4
Eagle	0	1	0	1	1	0	0	0	0	1	0.4
Elbert	0	0	0	0	0	0	0	0	1	0	0.7
El Paso	7	5	8	1	3	3	10	5	4	8	0.8
Fremont	0	0	0	0	0	0	1	1	0	0	0.8
Garfield	0	0	0	1	2	2	1	0	1	1	1.7
Jefferson	8	3	2	4	3	3	3	2	4	4	0.6
La Plata	0	1	0	0	0	0	0	1	0	0	0.4
Larimer	2	4	3	1	2	4	1	1	1	2	0.5
Las Animas	0	0	0	0	0	0	0	0	1	1	2.8
Logan	0	0	0	1	0	1	0	0	0	0	0.9
Mesa	1	1	2	0	1	1	0	4	0	1	0.8
Montezuma	0	0	0	0	0	0	0	0	2	0	1.5
Montrose	0	0	0	0	1	0	0	0	0	0	n/a
Morgan	2	1	0	1	0	1	2	0	0	1	2.8
Park	0	0	0	0	0	0	1	0	0	0	1.1
Pitkin	0	0	0	1	1	0	1	0	0	0	1.1
Prowers	0	0	2	0	0	0	0	0	0	0	n/a
Pueblo	1	1	2	2	3	2	3	2	1	1	1.1
Saguache	0	0	1	0	2	0	0	0	1	0	3.0
San Miguel	0	0	0	0	0	1	0	0	0	0	2.4
Summit	0	1	0	0	0	0	1	1	0	0	1.3
Teller	0	1	0	0	1	0	0	0	0	0	n/a
Weld	4	7	0	3	1	1	4	3	1	3	0.8
Yuma	0	0	1	0	0	0	1	0	0	0	2.0
TOTAL	70	64	74	64	73	64	84	64	66	52	1.2

^aOnly counties reporting an active case of TB (2011-2020) are included.

^b Highlighted counties reported at least one case of active TB in 2020.

^cTB cases per 100,000 persons

^d Population data for determining the case rates throughout this report are from the Colorado Division of Local Government, State Demography Office.



Table 2. Demographic Comparison of 2019 and 2020 TB Patients

	2019		2020	
	n	%	n	%
Age Group (years)				
<15	6	9.0	5	9.6
15-24	9	13.6	6	11.5
25-44	17	25.8	15	28.8
45-64	17	25.8	14	26.9
65+	17	25.8	12	23.1
TOTAL	66	100	52	99.9
Gender				
Male	28	42.4	32	61.5
Female	38	57.6	20	38.5
TOTAL	66	100	52	100
Race/Ethnicity				
White	8	12.1	4	7.7
Black or African American	13	19.7	7	13.5
Hispanic	19	28.8	21	40.4
American Indian or Alaska Native	1	1.5	1	1.9
Asian	24	36.4	19	36.5
Native Hawaiian or Other Pacific Islander	1	1.5	0	0
Multiple race/Unknown	0	0	0	0
TOTAL	66	100	52	100
Region				
Denver-metro ^a	53	80.3	33	63.5
Outside Denver-metro	13	19.7	19	36.5
TOTAL	66	100	52	100
HIV Status				
HIV Negative	61	92.4	46	86.5
HIV Positive	3	4.6	3	5.8
Testing done, results unknown	0	0	0	0
Refused testing	0	0	0	0
Not offered	2	3.0	2	5.8
Not offered- dead at diagnosis	0	0	1	1.9
TOTAL	66	100	52	100
Risk factors^b				
Birth in one of the 30 highest TB-burden countries ^c	25	37.9	14	26.9
Homeless within past year	1	1.5	0	0
Diabetes	8	12.1	9	17.3
Resident of correctional facility at diagnosis	1	1.5	0	0
Resident of long-term care facility	1	1.5	0	0
Injected drug use within past year	0	0	0	0
Non-injected drug use within past year	1	1.5	0	0
Excess alcohol use within past year	2	3.0	5	9.6
Health care worker within past year	0	0	0	0

Note: percentages may not equal 100 due to rounding.

a. Denver metro includes: Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas and Jefferson counties.

b. A case may have more than one risk factor indicated.

c. According to the World Health Organization's definition of 30 highest-burden countries

http://www.who.int/tb/publications/global_report/en/ Annex 2. Country profiles

TB by Race/Ethnicity

The number of people reported with TB in Colorado for the last decade has been highest among racial and ethnic minorities. Though comprising only 32% of the state’s population, 92% of new TB disease occurred in racial and ethnic minority populations (Figure 4). At 2.7 cases per 100,000 people in Colorado, the case rate in racial and ethnic minorities is 27 times that of the majority white population (Figure 5).

Figure 4. TB patients by race/ethnicity: Colorado 2020

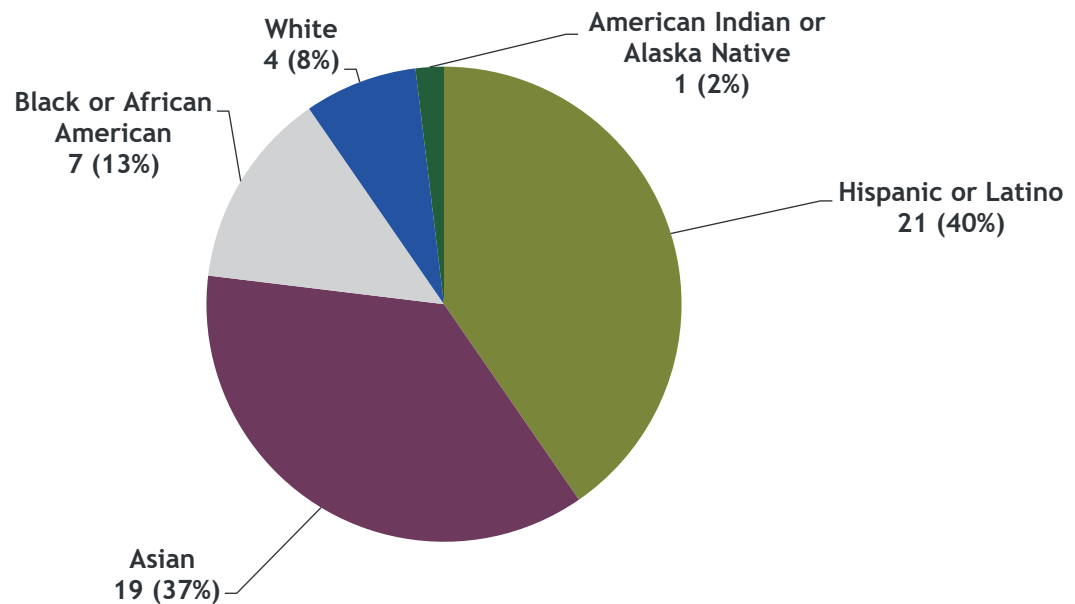
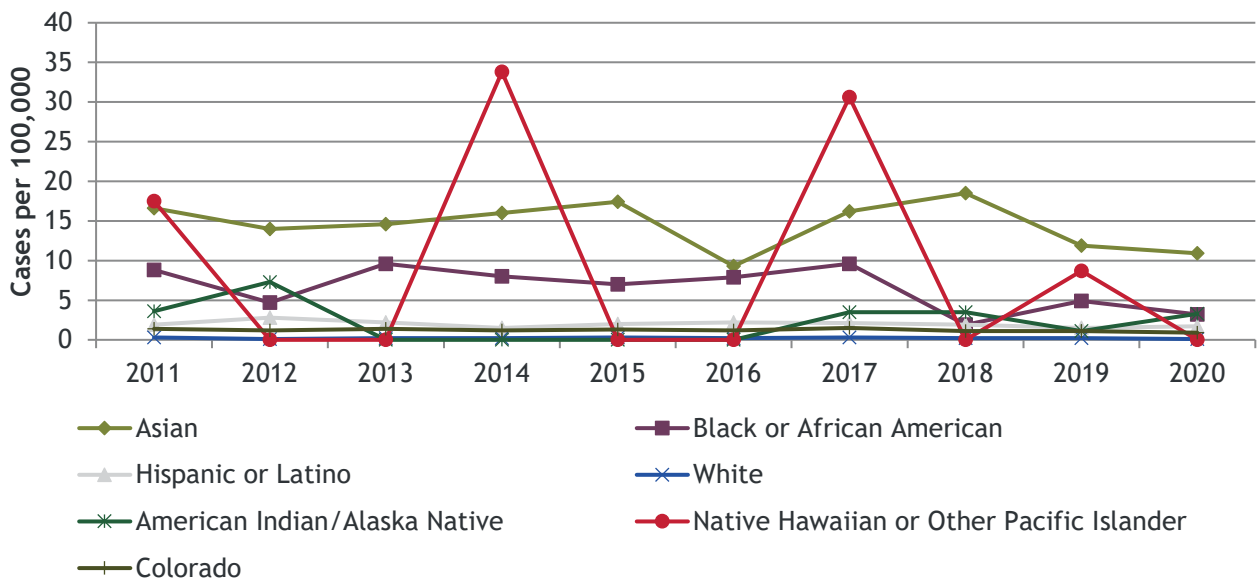


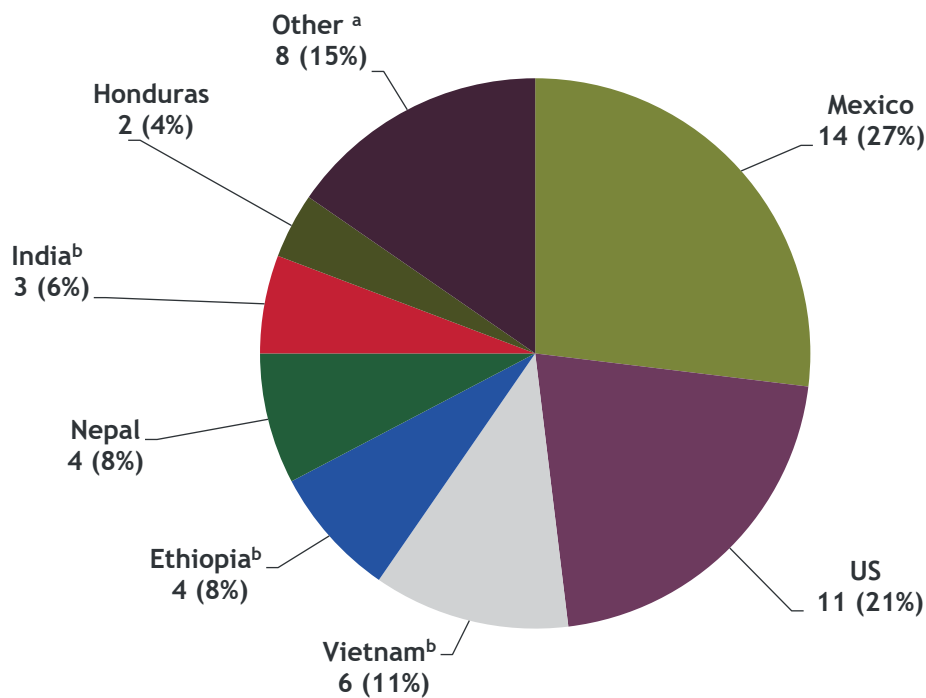
Figure 5. TB case rates by race/ethnicity: Colorado 2011-2020



TB by Country of Birth

TB disease was diagnosed in people originating from 14 different countries in 2020. The largest cohort came from Mexico with 14 people followed by the United States with 11. Of people born outside of the United States, 14 (27% of all patients) came from one of the [top 30 highest-burdened countries](#), which comprise 85-89% of all global TB disease according to the World Health Organization (WHO) (Figure 6).

Figure 6. TB patients by country of birth: Colorado 2020



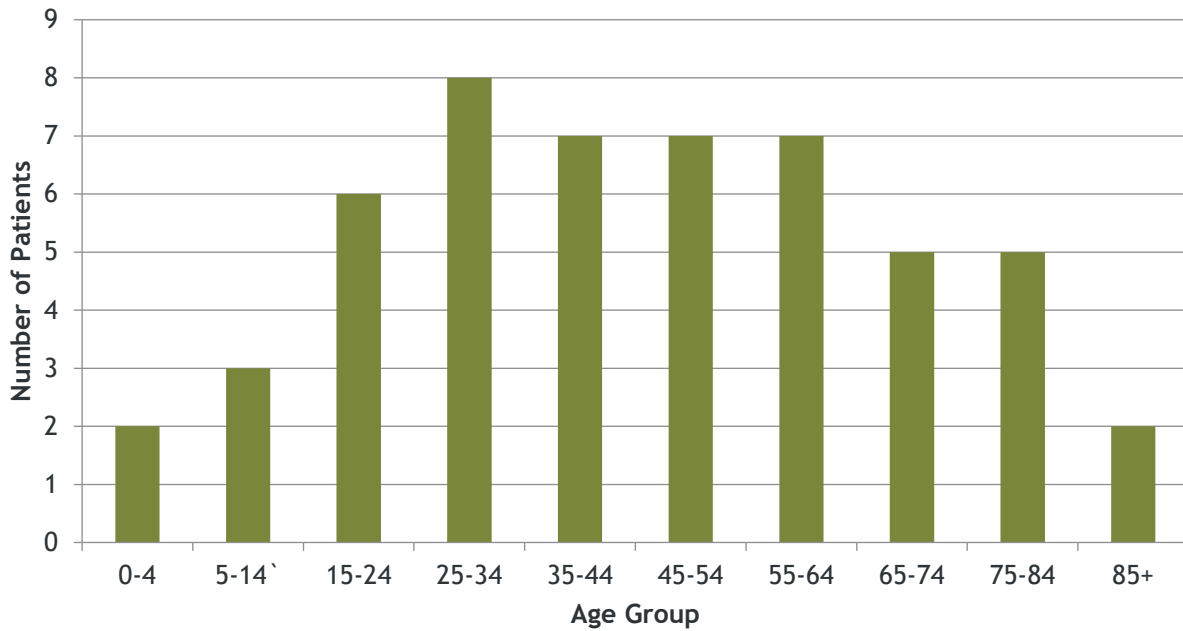
^aOther countries: Bhutan-1, Colombia-1, Congo^b-1, Eritrea-1, Malaysia-1, Morocco-1, Somalia-1, Unknown-1

^bDenotes one of the 30 highest TB burden countries according to the World Health Organization ([http://www.who.int/tb/publications/global_report/en/Annex 2. Country profiles](http://www.who.int/tb/publications/global_report/en/Annex%20Country%20profiles))

Tuberculosis by Age Group

In 2020, TB was reported among people ranging in age from newborn to 90 years. The greatest percentage occurred among people 25-44 years old (29%) followed by those 45-64 years old (27%) and in those 65+ years (23%). There were five children (10%), defined as <15 years of age, diagnosed with TB disease in 2020. This is concerning because TB in children is an indication of recent transmission and missed opportunities for TB prevention (Figure 7).

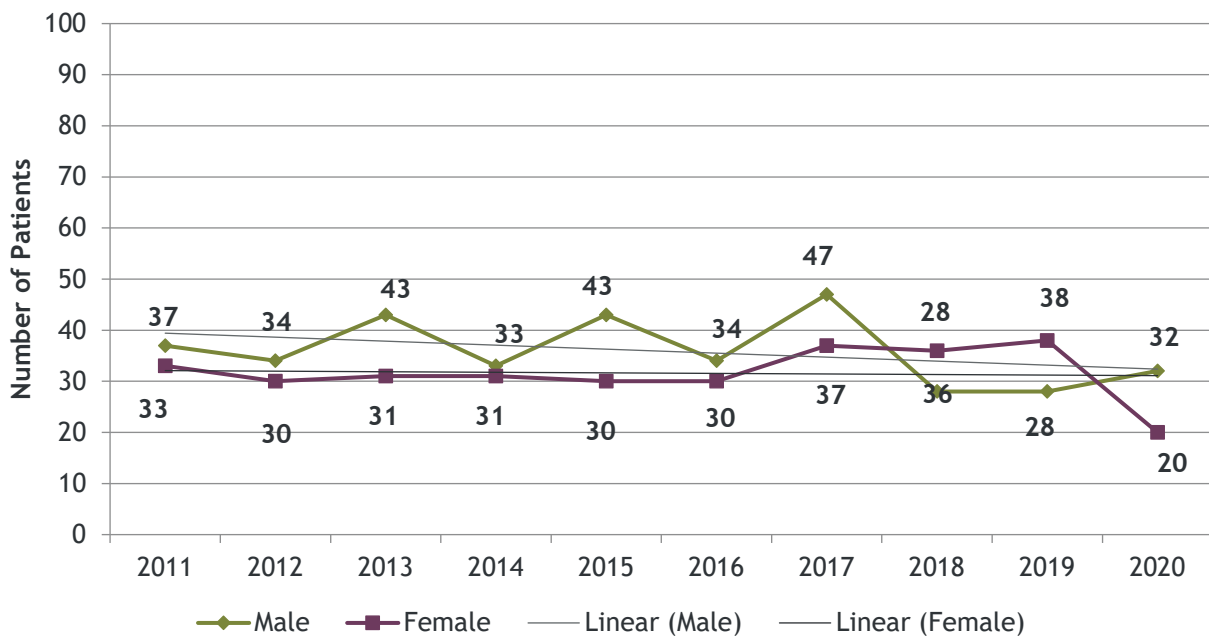
Figure 7. TB patients by age group: Colorado 2020



Tuberculosis by Gender

In 2020, 62 percent of new TB patients were male and 38 percent were female. There was a significant drop in the overall number of cases in females in 2020 (Figure 8).

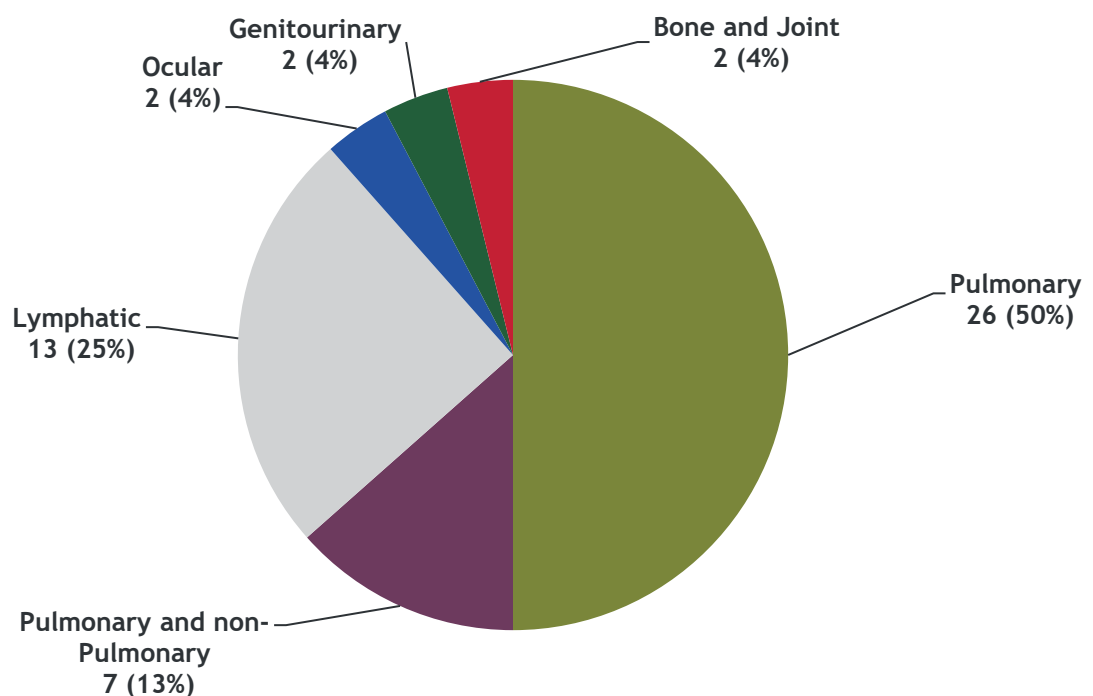
Figure 8. TB patients by gender: Colorado 2011-2020



Tuberculosis Patients by Major Site of Disease

Tuberculosis most often attacks the lungs (pulmonary TB) but may also affect other areas of the body (extra-pulmonary TB). In 2020, 33 of the 52 (63%) patients had a pulmonary or both a pulmonary and extra-pulmonary site of disease. The next most common site of infection in 2020 was lymphatic TB with 13 incidences (25%). (Figure 9).

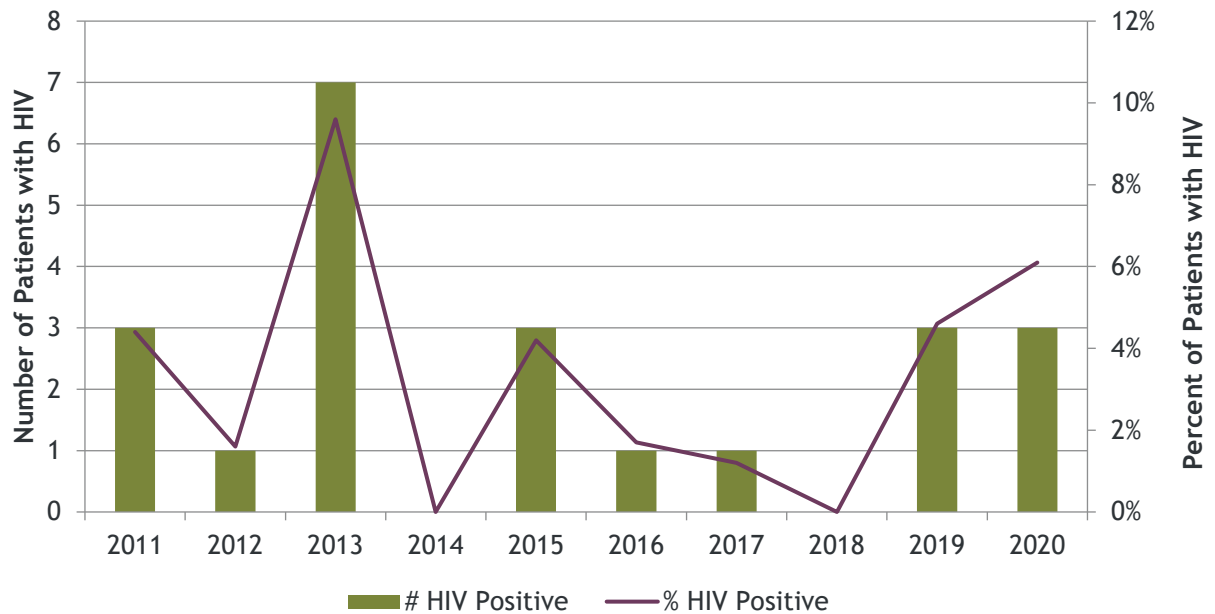
Figure 9. TB patients by major site of disease: Colorado 2020



HIV Co-infection

Worldwide, one in four people with HIV who die of AIDS-defining conditions do so from TB disease. HIV-infected people with TB infection are at higher risk of progression to TB disease because HIV weakens the immune system. Of the 52 people with TB in 2020, recent HIV test results were available for 49 (94% of total). Three people were co-infected with HIV in the 2020 cohort. Of the three people who were not tested, one was dead at diagnosis, two were not offered an HIV tests due to age (one was less than 3 years old and one was over 80 years old) (Figure 10). Over the past 10 years, HIV/TB co-infection has fluctuated between seven patients in 2013 (10% of total) to zero patients in 2014 and 2018. When analyzing small numbers, it is important to note that the percentages can fluctuate widely and incidence rates, being unstable and imprecise, are likely to lack statistical significance (Figure 10).

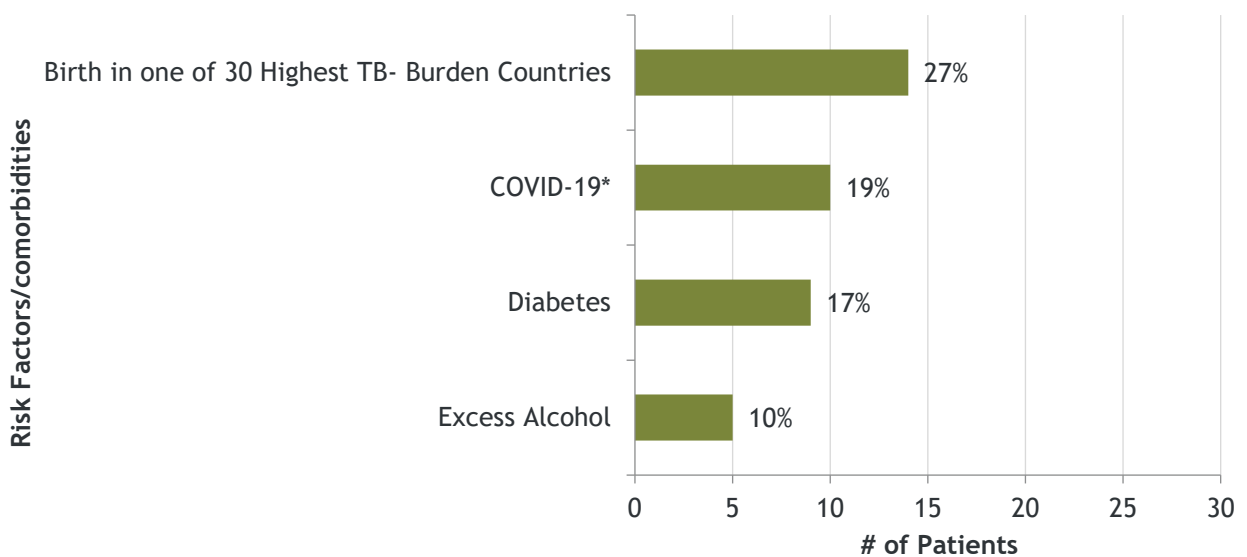
Figure 10. HIV-positive TB patients and percentage of annual total: Colorado 2011-2020



Risk Factors and Comorbidities

In 2020, the most common risk factor for TB disease was birth in one of the [30 highest TB-burden countries](#). The most common comorbidity was a COVID-19 diagnosis (Figure 11). *COVID-19 numbers are reflective of the number of TB patients who had a positive COVID-19 test at any time during 2020; a correlation between the two variables has not been established at time of publishing.

Figure 11. Risk factors and Comorbidities for TB: Colorado 2020

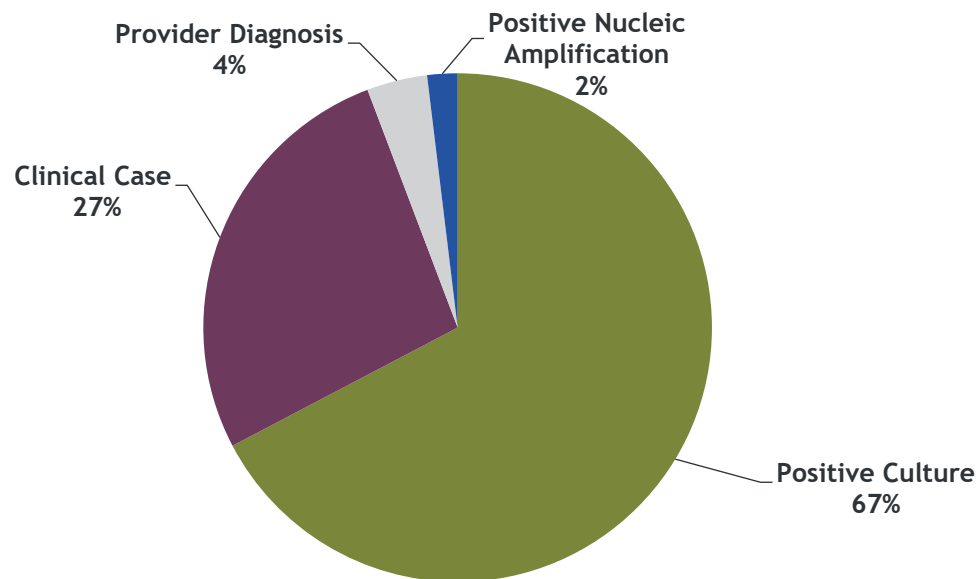


Note: A TB patient may have more than one risk factor indicated/Percentages may not equal 100%

Tuberculosis Case Verification

Mycobacterium tuberculosis complex was culture-positive in 67% of the TB patients in 2020. Another 27% met the clinical case definition (positive tuberculin skin test or interferon gamma release assay [IGRA] with an abnormal chest radiograph), 4% were verified by provider diagnosis, and 2% had a positive nucleic amplification test (Figure 12). For more information on verification criteria visit CDC's [website](#).

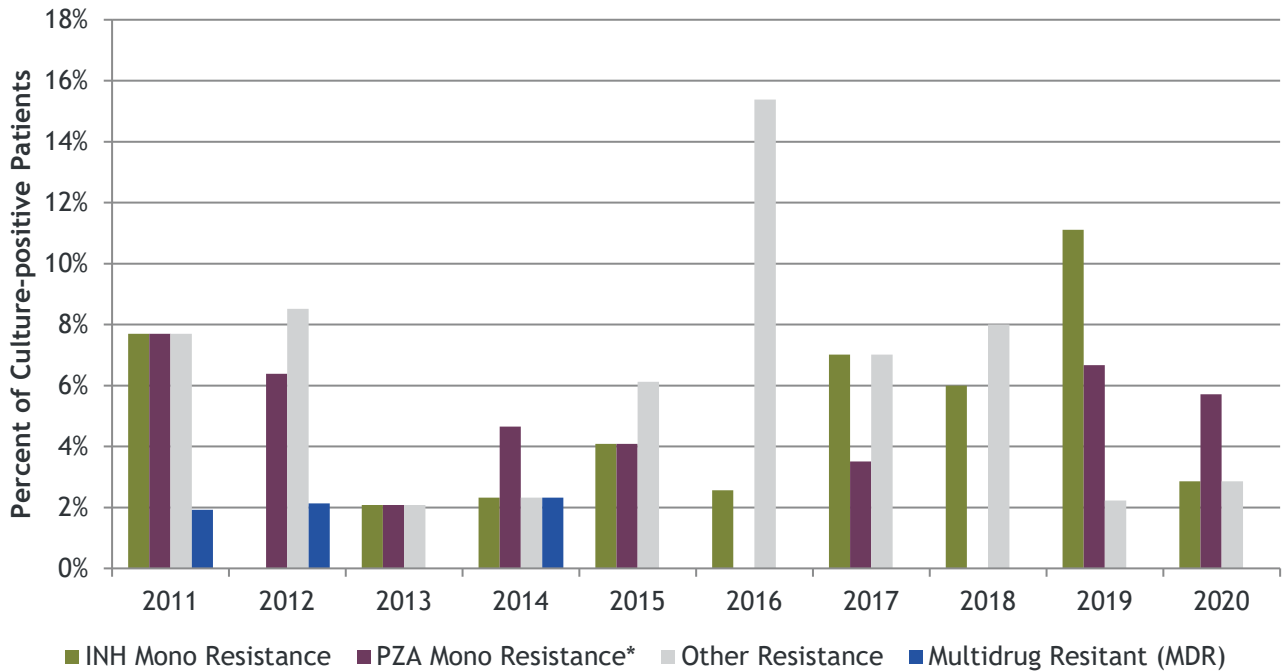
Figure 12. TB patients by verification criteria: Colorado 2019



Drug Resistance and Tuberculosis

Of the 52 TB patients reported in 2020, 35 (67%) had a positive culture and of those 34 had drug susceptibility testing completed. Four (11% of culture positive patients) were found to be resistant to one or more TB drugs. All four were resistant to one or more of the four first-line TB drugs: isoniazid (INH), rifampin (RIF), pyrazinamide (PZA) and ethambutol (EMB). Of those four resistant to at least one first-line drug, one had INH mono-resistance, one was resistant to INH and streptomycin, and two were resistant to PZA. There was no multi-drug resistant (MDR: defined as being resistant to at least INH and RIF), or extensively-drug resistant TB (XDR: defined as being resistant to isoniazid and rifampin, plus any fluoroquinolone and at least one of three injectable second-line drugs [i.e., amikacin, kanamycin, or capreomycin]) identified in 2020 (Figure 13).

Figure 13. TB drug resistance: Colorado 2011-2020

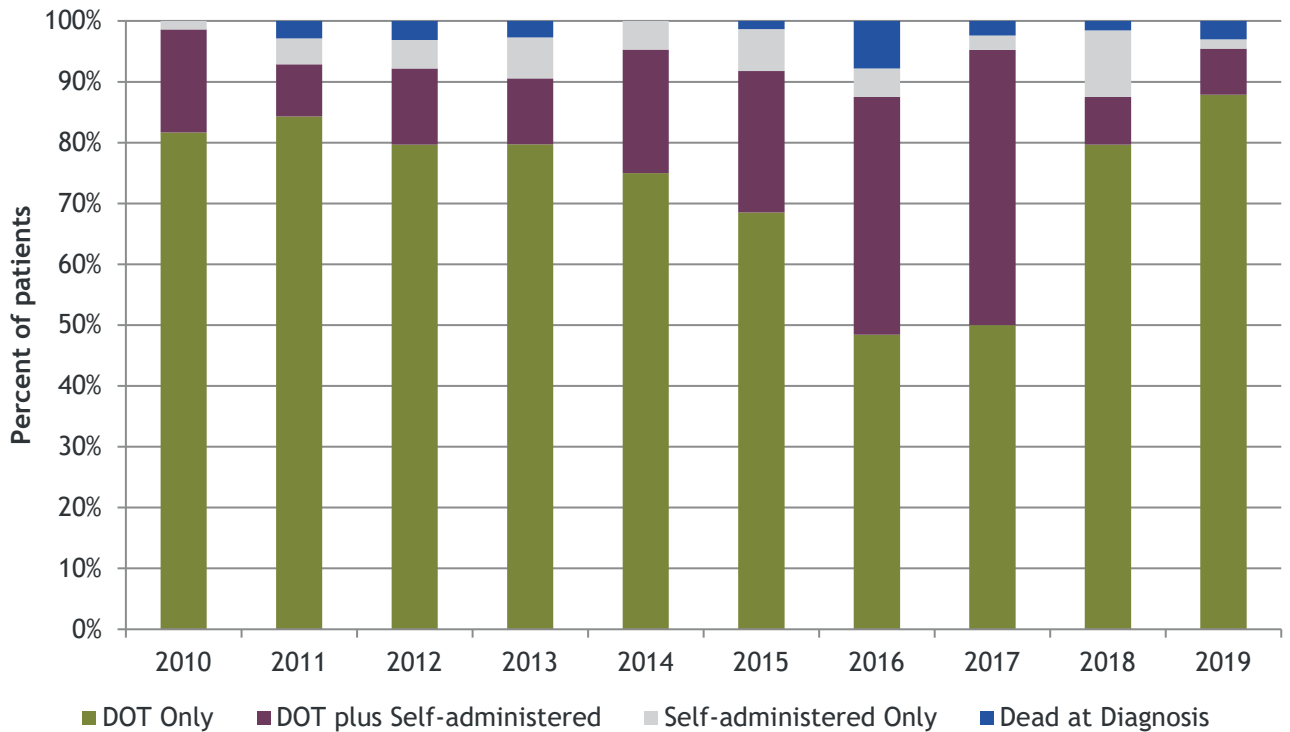


*Isolates with PZA resistance may indicate *Mycobacterium Bovis*, a form of tuberculosis, which causes tuberculosis in humans, cattle, and mammals. It is characteristically resistant to PZA.

Directly Observed Therapy

Directly observed therapy (DOT) is required for all patients with pulmonary TB in Colorado. DOT means a trained health care worker observes the patient taking every dose of his/her TB medications. During 2019 (the most recent year with complete data), of the 64 patients who initiated treatment, 90% received medications via DOT, 2% self-administered medications (non-infectious extra-pulmonary patients) and 8% received a combination of DOT and self-administered therapy (Figure 14).

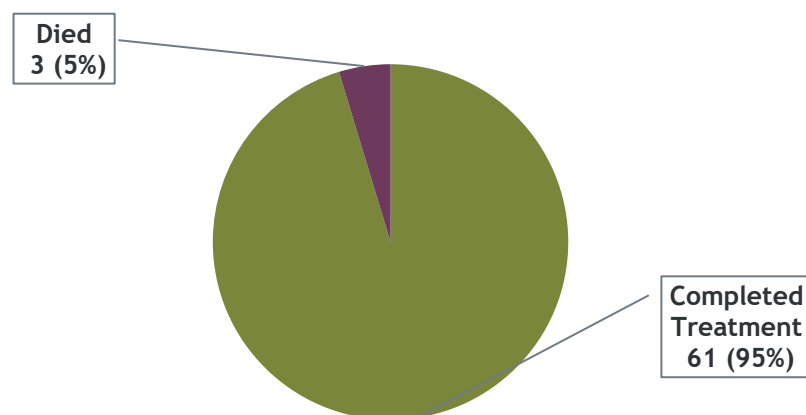
Figure 14. Mode of TB therapy: Colorado 2010-2019



Tuberculosis Treatment Outcomes

The standard treatment for TB disease is six months using isoniazid, rifampin, ethambutol and pyrazinamide. Of the 66 patients in 2019 (the most recent year with complete data), 64 TB patients (97%) initiated treatment (two patients were dead at diagnosis). For those who initiated treatment, 61 completed and three died during treatment (Figure 15). All 2020 patients have initiated treatment.

Figure 15. TB treatment outcomes: Colorado 2019



In 2019, there were 55 patients who were expected to complete TB treatment within one year of diagnosis and of those, 52 (95%) completed within that expected timeframe. Three others completed treatment in more than one year (Figure 16).

Figure 16. Completion of TB treatment within one year: Colorado 2010-2019



Note: Excludes patients with rifampin-resistant disease, patients with meningeal, bone and/or joint, or central nervous system disease, patients less than 15 years of age with disseminated tuberculosis disease, and patients that died less than one year after treatment initiation or moved out of the country.

Cascade of Care for Individuals at High-Risk for TB Infection

The key strategy for eliminating TB in Colorado is to identify and then treat people with TB infection (also known as latent TB infection or LTBI) who are at high-risk of developing TB disease. Timely evaluation of both people identified as contacts to an infectious TB patient and of those who arrive in Colorado with a Class B TB designation is vital to the success of this strategy. The Class B TB designation includes immigrants and refugees who are traveling to the United States. They are evaluated for TB prior to arrival in the U.S. as required by U.S. immigration law and are assigned a classification according to the status of their disease. CDC’s Division of Global Migration and Quarantine notifies CDPHE’s TB Program of all individuals known to be traveling to Colorado who are non-infectious but are in need of additional TB evaluation (referred to as Class B TB). By evaluating those at high-risk, specifically



contacts to pulmonary TB patients and those designated with a Class B TB designation, and treating those diagnosed with either TB disease or TB infection (Figure 17 and Table 3), further cases of TB disease can be prevented. Data provided here are from 2019, the most recent year with complete data.

Figure 17. Cascade of care for high-risk individuals (Contacts and Class B TB): Colorado 2019

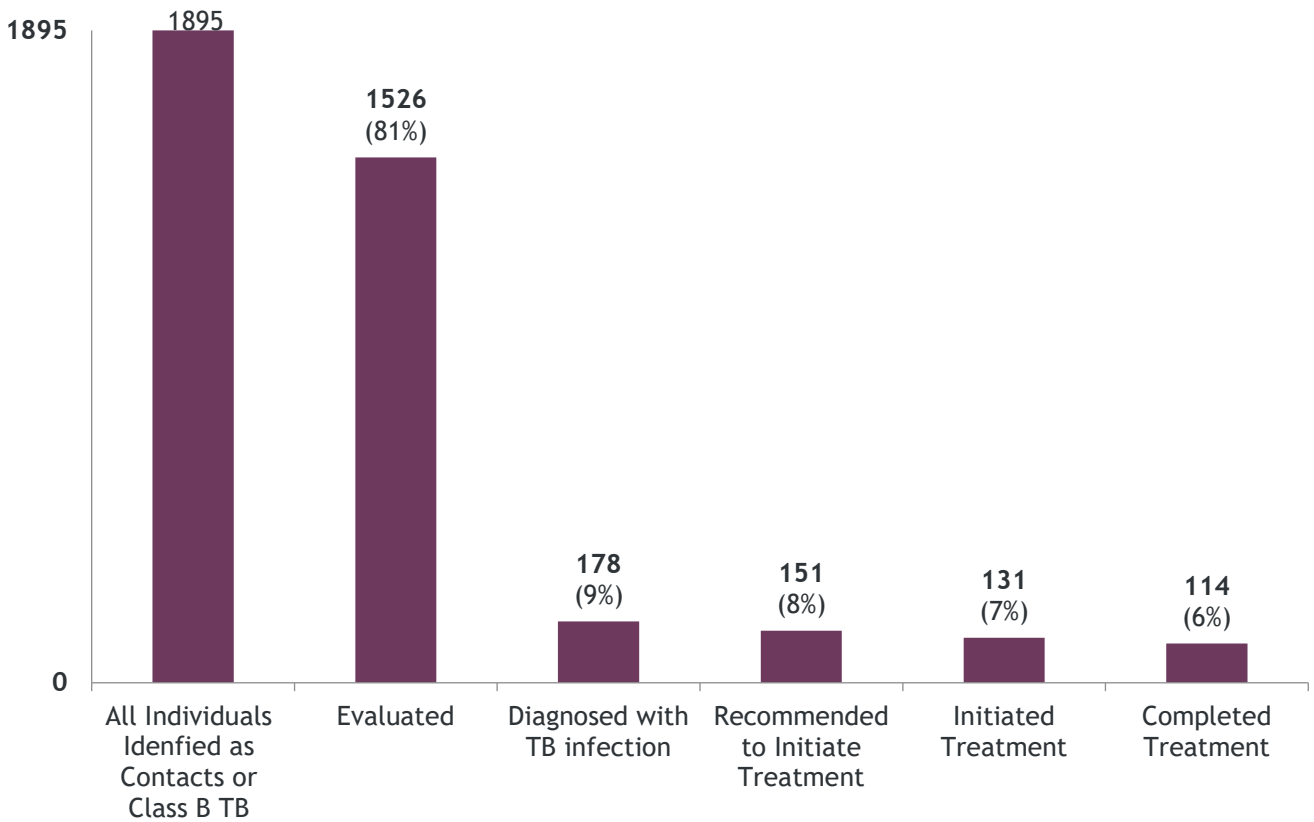


Table 3. Treatment outcomes for high-risk individuals (Contacts and Class B TB) recommended to initiate TB infection treatment: Colorado 2019

Outcomes	No.	(%)
Total Diagnosed with TB Infection	178	(100%)
Recommended to Initiate Treatment	151	(85%)
Initiated Treatment	131	(87%)
Completed Treatment	114	(87%)
Did Not Complete Treatment (Reasons below)		
Died	0	(0%)
Moved	2	(2%)
Developed TB disease	0	(0%)
Adverse Effect/s	2	(3%)
Patient Chose to Stop	3	(4%)
Lost to Follow-up	1	(1%)
Provider Decision to Stop	2	(2%)
Pending Outcome Documentation	1	(1%)

Conclusions and Next Steps

In 2020, 52 people were diagnosed with tuberculosis (TB) disease, a decrease of 21% from the 66 reported in 2019 (Figure 1 and Table 1). The Colorado case rate declined to 0.9 per 100,000 people (the lowest rate on record) from 2019's rate of 1.1 per 100,000 people. Similarly, the number of reported cases in the U.S. in 2020 decreased 20% from 2019. The U.S. case rate was 2.2 per 100,000 people according to CDC's [March 2020 TB report](#) (Figure 2). There are several factors that have likely contributed to the decline; under- or misdiagnoses due to COVID-19 that led to some individuals delaying care as well as COVID-19's similar respiratory symptoms leading to misdiagnoses. There was also a decline in travel to and from endemic areas in 2020, and the successful employment of mitigation strategies meant to slow the spread of COVID-19 such as consistent use of masks, self-isolating when feeling ill and maintaining social distancing when outside the household. As the demographic breakdowns in this report attest, the key risk factors and the most at-risk groups for developing TB disease have been identified (see Figures 5 and 11). No meaningful TB elimination plan activities were initiated in 2020 due to local public health and CDPHE TB staff secondment or reallocation to emergent COVID-19 pandemic response efforts. The hope is that as vaccination rates rise in Colorado, COVID-19 morbidity will decrease, allowing TB staff to return to core TB surveillance and case management duties. Next steps for 2021-2022 remain in development due to the comprehensive COVID-19 response. The goal is to tailor traditional in-person TB training curricula to a remote online platform including self-paced courses. Other ongoing strategies include promoting and facilitating a regional collaboration model toward improving case management and community engagement activities in under-resourced jurisdictions; the continued provision of no-cost V-DOT services to local public

health agencies statewide; and the pursuit and promotion of opportunities to replicate the ongoing TB infection screening, testing and treatment pilot underway by a private healthcare provider network. Monthly enhanced TB case management (ECM) sessions designed to educate providers and increase capacity among those caring for TB patients will continue. These ECM sessions allow non-Denver-metro LPHAs and providers that care for TB patients the opportunity to review current patients during live sessions with subject matter experts from CDPHE and the Denver Metro TB Clinic via a web-based, HIPAA-compliant online/remote platform. Discussions are underway to develop and offer a multi-session Project ECHO-type TB infection screening, testing and treatment course tailored to private providers to promote and de-mystify TB infection treatment with the hope that more patients diagnosed with TB infection can be treated to completion by their PCP rather than referred to LPHAs. Other plans carried into 2021-2022 include developing a nurse case-management tool kit to guide LPHA case managers through the chronological steps necessary to guide a patient with TB disease through completion of treatment. Efforts will continue to support non-LPHA agencies and other healthcare providers by developing site-specific algorithms to screen, test and treat their patients at-risk for TB infection. This strategy is crucial, as private providers will need to care for their TB-infected patients in order to avoid over-burdening local public health agencies with referrals, as past practice dictated.

CDPHE will continue efforts to engage affected communities and populations in TB elimination activities. CDPHE's TB Training and Education Coordinator continues to spearhead the planning, collaboration, and implementation of these activities in coordination with TB Program colleagues and community partners. Community participation is essential to developing meaningful content that will resonate with individuals at-risk for both TB infection and progression to TB disease. Reducing health disparities through improved policies, practices and organizational systems will benefit the entire state and help in the improved TB-specific health outcomes for all Coloradans impacted by the leading infectious disease killer in the world. Colorado's TB elimination plan is available on the TB Program website <https://www.colorado.gov/pacific/cdphe/tb>.