2022 Annual Tuberculosis Report
Fresno County

Fresno County Department of Public Health (FCDPH)
Tuberculosis Control Program

2022 Annual Tuberculosis Report
Fresno County

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3HP – Once-weekly Isoniazid-Rifapentine for 12 Weeks
AFB – Acid-Fast Bacilli
CDC – Centers of Disease Control and Prevention
CDPH – California Department of Public Health
DOT – Direct Observed Therapy
Dx – Diagnosis
EMB – Ethambutol
ETH – Ethionamide
FCDPH – Fresno County Department of Public Health
HIV – Human Immunodeficiency Virus
INH – Isoniazid
LTBI – Latent Tuberculosis Infection
MDR-TB – Multi-Drug-Resistant Tuberculosis
MOX – Moxifloxacin
NHPI – Native Hawaiian Pacific Islander
NTIP – National Tuberculosis Indicators Project
Pre-XDR-TB – Pre-Extensively Drug-Resistant Tuberculosis
PZA – Pyrazinamide
RIB – Rifabutin
RIF – Rifampin
RIP – Rifapentine
RR-TB – Rifampicin-Resistant Tuberculosis
Rx – Prescription
SM – Streptomycin
TB – Tuberculosis
TNF-Alpha – Tumor Necrosis Factor Alpha
WHO – World Health Organization
XDR-TB – Extensively Drug-Resistant Tuberculosis

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Tuberculosis Burden Summary

Globally[1,2,3,4]

During 2022, an estimated 10.6 million people (range, 9.9 – 11.4) became sick with tuberculosis (TB), resulting in an incident of 133 cases (range, 124 – 143) per 100,000 population. These numbers represent an increase in TB disease burden compared to 2020 and 2021. This increase is likely the result of undiagnosed and underreported TB cases from the prior pandemic years.

Worldwide, most TB cases are in adults (90%) that are male (55%). Two thirds of TB cases originate from eight countries: India (27%), Indonesia (10%), China (7.1%), the Philippines (7.0%), Pakistan (5.7%), Nigeria (4.5%), Bangladesh (3.6%), and the Democratic Republic of the Congo (3.0%).

From 2010 to 2019, the number of TB deaths declined globally, but this trend was reversed in both 2020 and 2021 due to the COVID-19 pandemic. The increase in TB deaths was the consequence of a disruption to TB diagnosis and treatment during the pandemic. Assuming pre-pandemic trends, the WHO estimates pandemic disruptions resulted in almost half a million extra TB deaths from 2020–2022. In 2022, less people died of TB than the prior two years reflecting better care for TB patients during the pandemic recovery. Estimates for the number of TB deaths in 2022 are 1.3 million (range, 1.18-1.43). TB is a leading killer of people who are HIV-infected, and in 2022 around 167,000 (range, 139,000 – 190,000) people with HIV died from TB. Despite this high number, there is a 69.7% reduction in HIV deaths from 2010-2022. During the same time span, the deaths among HIV – negative people dropped by 19.9%.

The WHO asserts that drug resistant TB is of great public health concern. From 2015-2020, the proportion of new TB cases that are rifampicin-resistant TB (RR-TB) or multi-drug resistant TB (MDR–TB) trended down. From 2020 to 2022, the trend flattened. In 2022, there were an estimated 410,000 (range, 370,000 – 450,000) new MDR/RR-TB cases. The estimated number of new TB cases that were MDR/RR-TB was 3.3%, and 17% among those previously treated. In 2022, 25,075 extensively drug-resistant (XDR) or pre-XDR cases were reported globally.

Nationally[5,6,7,8]

A total of 8,300 TB cases (an incidence of 2.5 cases per 100,000 people) were reported in the United States in 2022. Compared to 2021, in 2022 the incidence increased by 4.2% and the number of cases increased by 5.3%. In 2022, California, Texas, New York, and Florida accounted for about half of all TB cases reported.

Minority populations continue to have the highest incidence of TB in the United States. The 2022 foreign-born TB incidence per 100,000 population for Native Hawaiians/Pacific Islanders (NHPI), Asians, Blacks, Hispanics/Latinos, American Indians/Alaska Natives, and Whites is 27.8, 22.0, 13.7, 10.1, 4.3, and 3.4 respectively. The 2022 incidence per 100,000 population for native-born TB cases who are Native Hawaiians/Pacific Islanders, Asians, Blacks, Hispanics/Latinos, American Indians/Alaska Natives, and White is 6.6, 2.2, 1.9, 1.4, 4.4 and 0.3 respectively.

Foreign-born people represent 73% of all TB cases in 2022. A breakdown of foreign-born cases by country from 2021 indicate the top 5 countries of birth for foreign-born TB cases are Mexico, the Philippines, India, Vietnam, and China. In addition to being foreign-born, other top risk factors for TB infection include HIV, substance abuse, diabetes, kidney disease, organ transplantation, homelessness, and institutionalization (prisons, shelters, nursing homes).

The most current MDR-TB numbers are from 2021 and indicate there were 77 MDR-TB cases, which is 19 more cases than in 2020.. There were 2 XDR-TB cases in 2021.

California[9,10]

In 2022, a that total of 1,843 new TB cases were reported compared to 1,750 cases in 2021. California reported 22.2% of the nation's TB cases in 2022. The California TB incidence during 2022 is 4.7 per 100,000 people, an increase of 6.8% compared to 2021. TB cases are reported in 42 (69%) of California's 61 local health jurisdictions.

Like the United States as a whole, minority populations continue to have the highest incidence of TB in California. The incidence of TB per 100,000 population for Asians, Native Hawaiian/Pacific Islanders, Hispanics, Blacks, and Whites is 17.7, 7.8, 4.8, 2.7, and 0.6 respectively.

Foreign-born people represent 83% of all TB cases and well over half of these cases were born in Mexico, the Philippines, Vietnam, China, and India.

It is estimated that 2 million Californians have a latent TB infection (LTBI) and are at risk of developing active TB if not properly diagnosed and treated. Many people with LTBI are unaware of their infection. Latent TB treatment is critical because an estimated 86% of active TB cases develop from LTBI.

In California from 1993-2022, MDR-TB has remained a small proportion of TB cases (1-2%). A total of 16 (0.9%) MDR-TB cases are reported in California during 2022. No Extensively Drug Resistant (XDR-TB) cases are reported in California during 2022, and 25 XDR-TB cases are reported from 1993-2022.

Fresno County

A total of 31 TB cases (an incidence of 3.1 cases per 100,000 people) were reported in Fresno County during 2022. Compared to 2021, in 2022 the incidence decreased by 20.5% and the number of cases decreased by 31.1%.

In 2022, most TB cases occurred in older adults (average age 56.1 years old), and more TB cases were male than female (67.7% vs. 32.3%). Over half of TB cases were not employed when they received their diagnosis.

Racial and ethnic disparities continue to exist among populations with TB disease in Fresno County. During 2022, the incidence of TB for Asians/NHPI, Hispanics/Latinos, Blacks/African Americans, and Whites is 10, 3.5, 2.0, and 0.3 per 100,000 people respectively. Foreign-born people represent well over half of all TB cases in 2022, and 86.1% of these cases arrived from Mexico, India, and the Philippines.

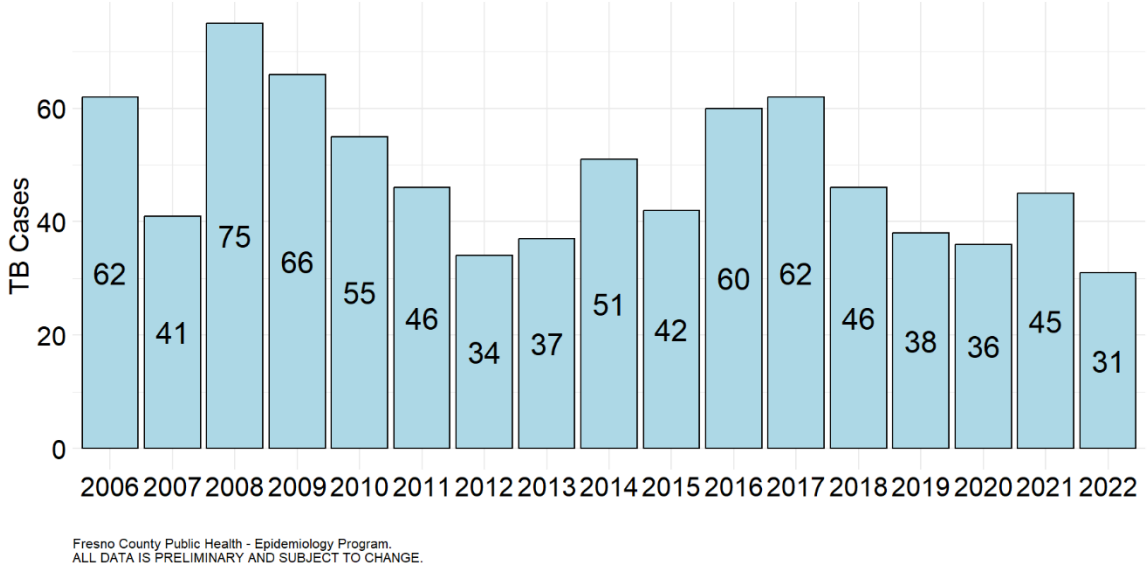
Social and behavioral risk factors identified in 2022 TB cases include alcohol and drug abuse, contact with an active TB case, migrant/seasonal work, health care work, and homelessness. Medical risk factors identified in 2022 TB cases include diabetes, HIV, immunosuppression, end stage renal disease, and a prior TB diagnosis.

In 2022, the MDR-TB incidence in was 0.1 per 100,000 people. A small increase from the prior year where no MDR-TB cases were reported.

Tuberculosis Cases and Incidence in Fresno County

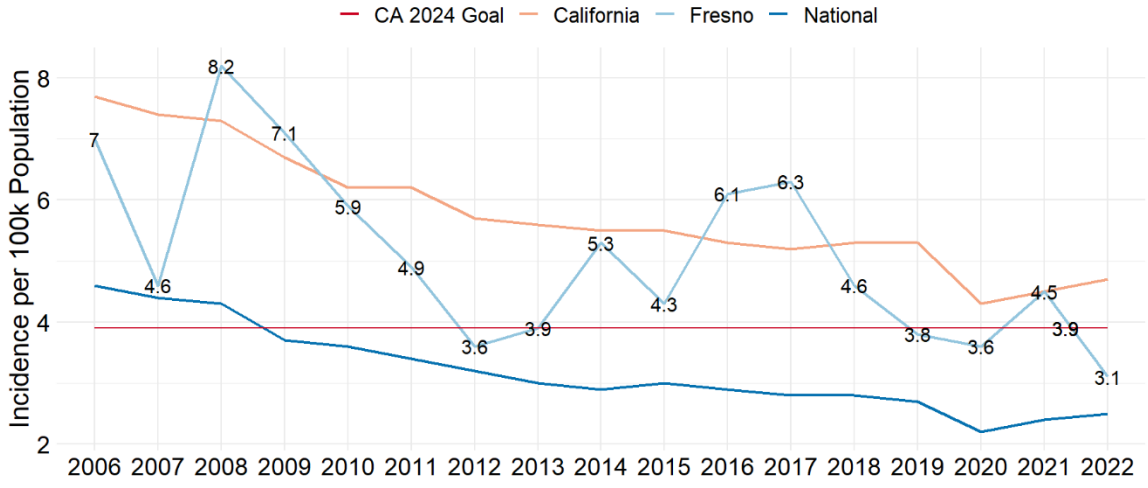
Tuberculosis (TB) is a common communicable disease caused by the bacterium *Mycobacterium tuberculosis*.[11] It most commonly infects the lungs, but can infect almost any organ system. In 2022, 31 new cases of active TB were diagnosed in Fresno County (3.1 per 100,000 population), a 31.1% decrease in the annual number of cases from 2021 (Figures 1-2). During 2022, out of the 61 health jurisdictions in California, the active TB incidence in Fresno County ranked 8th, and Fresno County reported 1.7% of the total number of TB cases in California.[9]

Figure 1. Annual New Active TB Case Counts in Fresno County – 2006-2022



Fresno County Public Health - Epidemiology Program.
ALL DATA IS PRELIMINARY AND SUBJECT TO CHANGE.

Figure 2. Annual National and State TB Incidence Compared to Fresno County – 2006- 2022*



*Data Sources:
Tuberculosis Control Branch, Provisional California Tuberculosis Data Tables. California Department of Public Health, Richmond, CA. September 2023.
Schildknecht KR, Pratt RH, Feng PI, Price SF, Self JL. Tuberculosis — United States, 2022. MMWR Morb Mortal Wkly Rep 2023;72:297–303.

Demographic Characteristics in Fresno County

Sex and Age

In 2022, 21 (67.7%) cases were male and 10 (32.3%) were female (Figure 3). Most TB cases in Fresno County occurred in older adults (Figure 4), and 16 (51.6%) cases during 2022 were over age fifty (data not shown). The average age of TB patients in Fresno County during 2022 was 56.1 years with a range from 23 to 91 years (Figure 5).

Figure 3. Percent Male vs Female TB Cases in Fresno County – 2016-2022

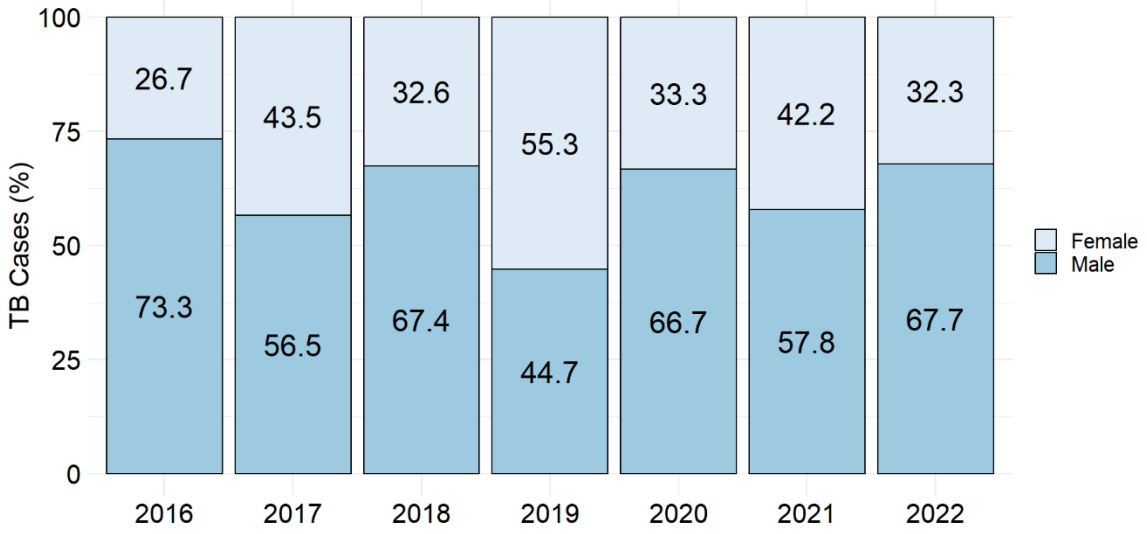


Figure 4. Age Distribution of TB Cases in Fresno County – 2022

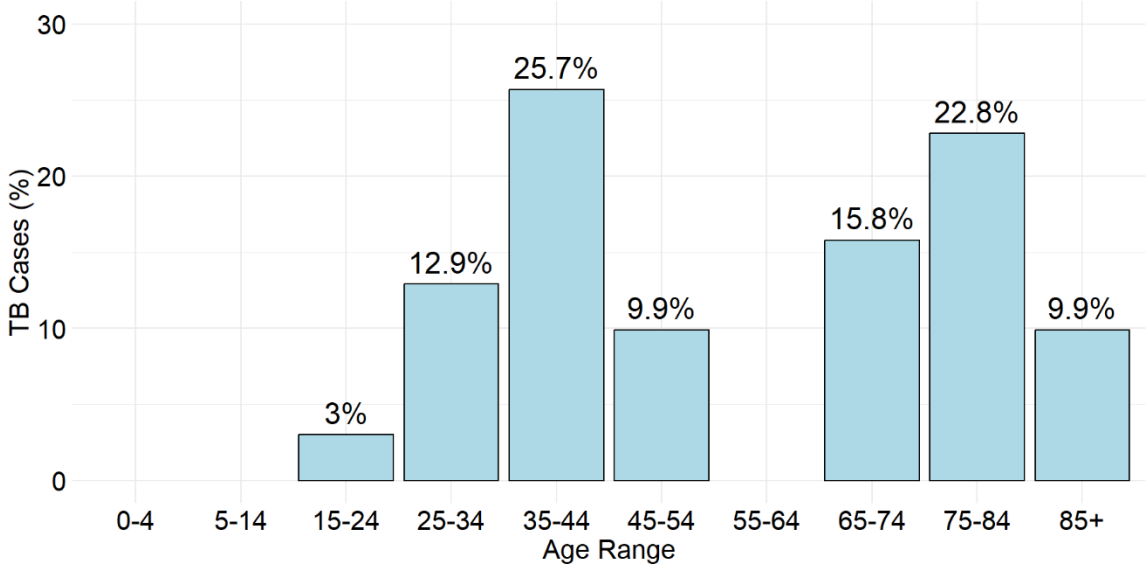
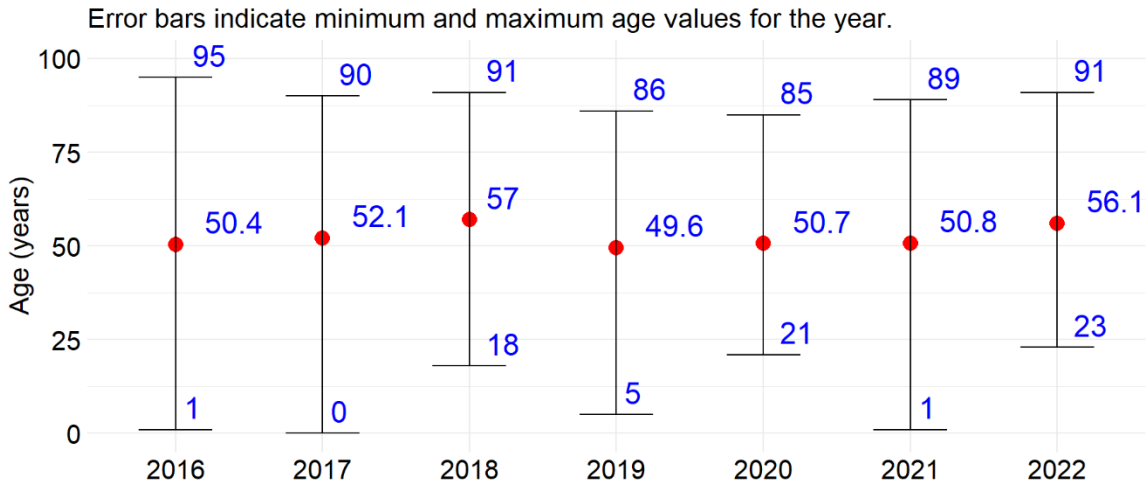


Figure 5. Average Minimum and Maximum Age at TB Diagnosis in Fresno County – 2016-2022



Nativity

Similar to prior years, during 2022 a smaller percentage of TB cases were among US-born residents compared to foreign-born people (Figure 6). The top three countries represented by foreign-born TB cases, accounting for 86.1% of all foreign-born cases, are Mexico, India, and the Philippines. Other countries represented by 2022 TB cases include El Salvador, Pakistan, and Viet Nam (Figure 7). During 2022, foreign-born TB patients spent an average of 20.9 years in the US prior to their TB diagnosis (Figure 8).

Figure 6. Nativity of TB cases in Fresno County – 2016-2022

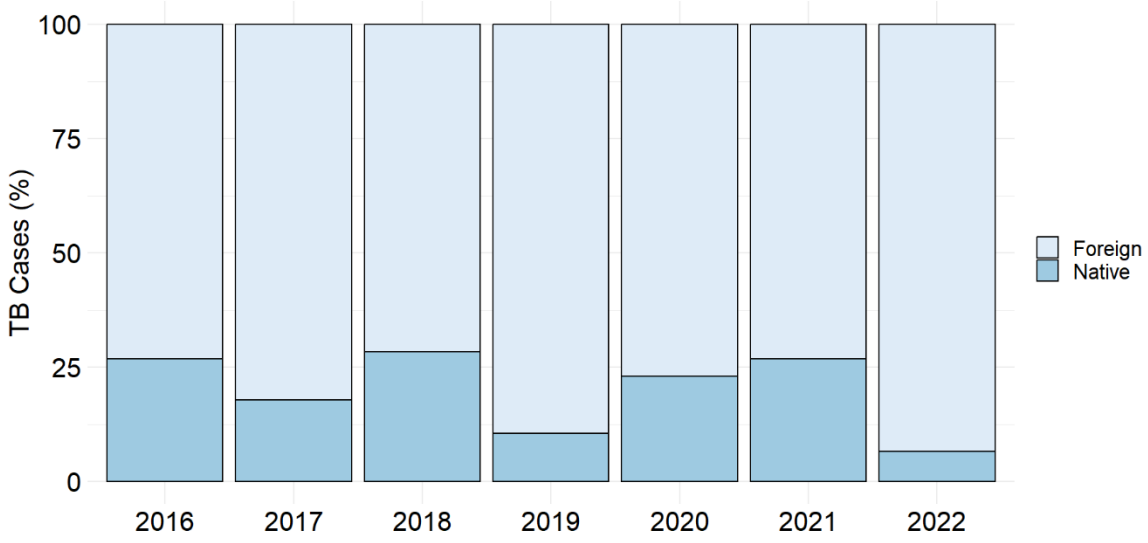


Figure 7. Birth Country for Foreign-Born TB Cases in Fresno County – 2022

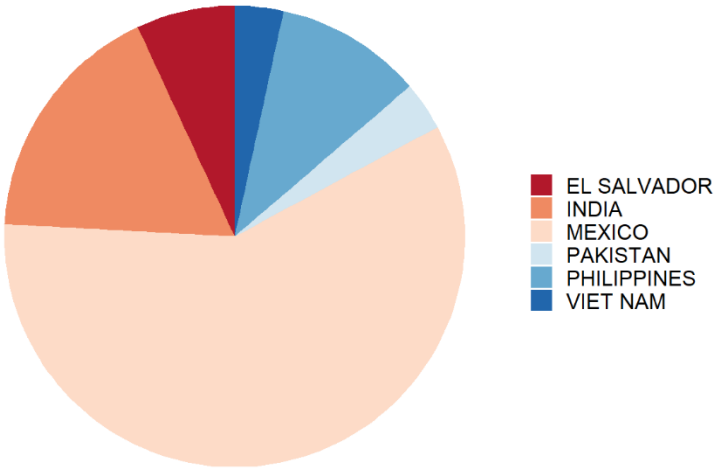
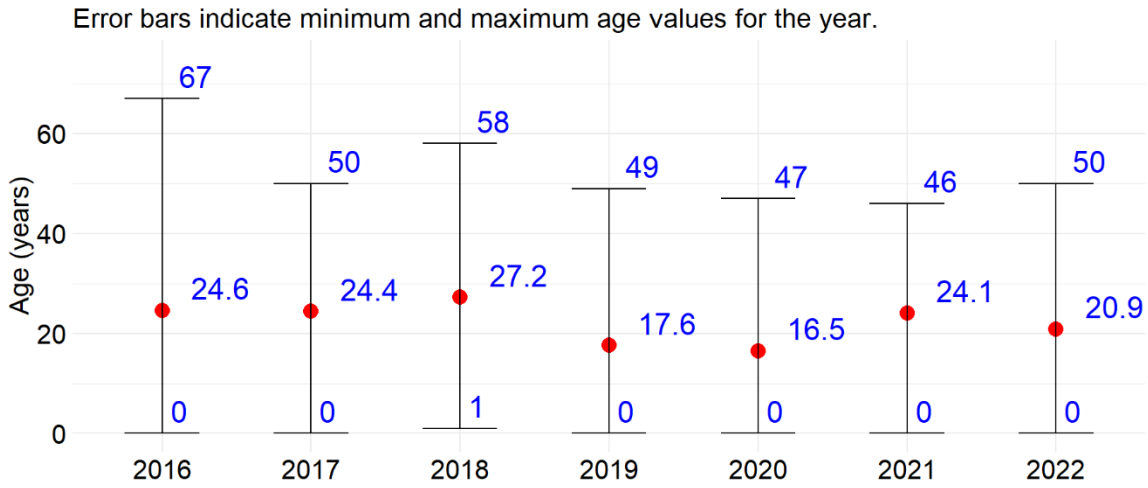


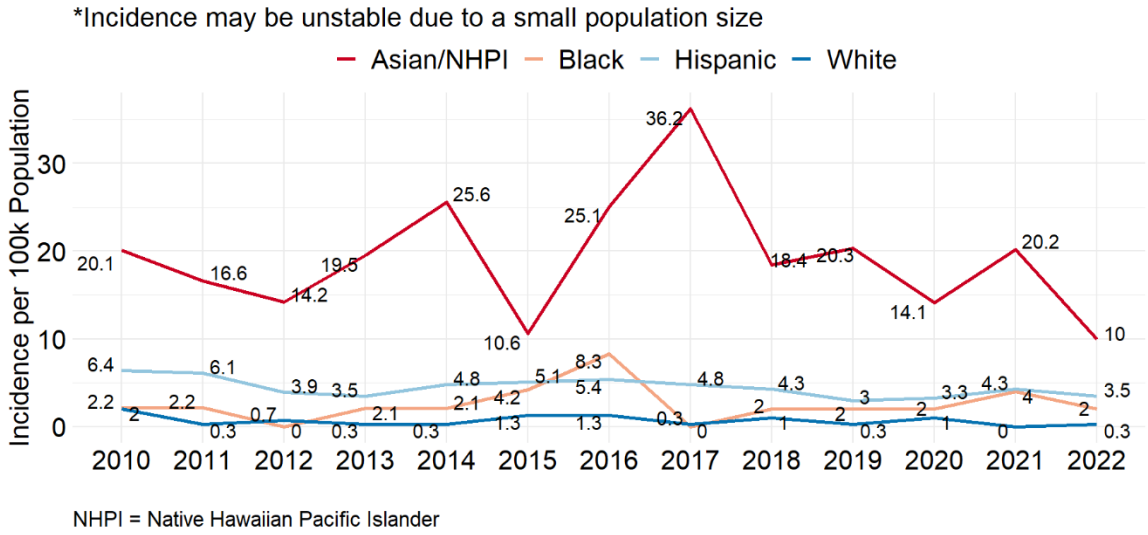
Figure 8. Average Minimum and Maximum Time from United States Arrival to Diagnosis for Foreign-Born TB Cases in Fresno County – 2016-2022



Race/Ethnicity

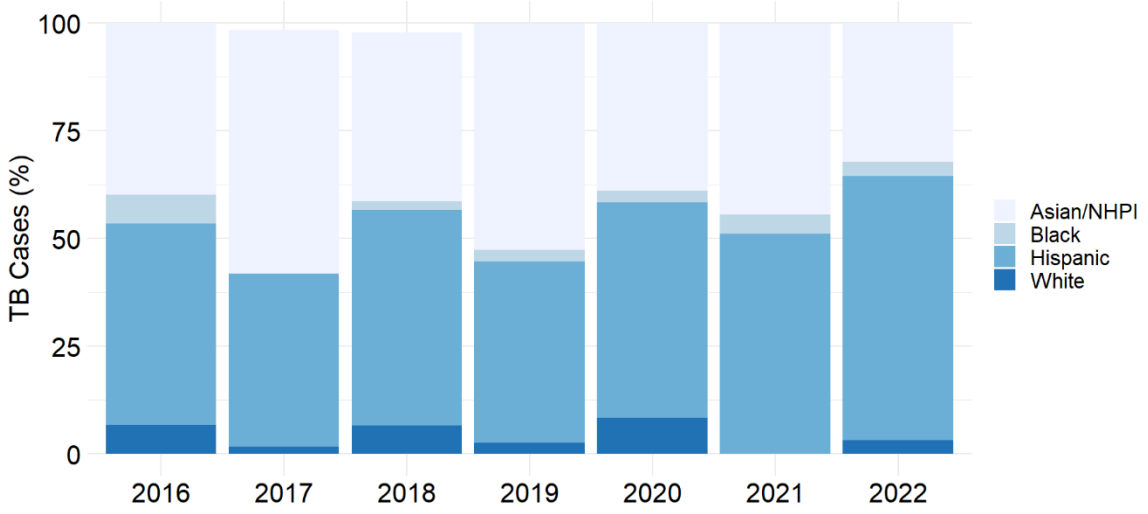
Racial and ethnic disparities exist among populations with TB disease in Fresno County (Figure 9 & Figure 10). The crude TB incidence in Fresno County for 2022 is 3.1 per 100,000 people (Figure 2). The race/ethnicity specific incidence for Asians/NHPI, Hispanics/Latinos, Blacks/African Americans, and Whites is 10, 3.5, 2.0, and 0.3 per 100,000 people respectively (Figure 9).

Figure 9. TB Incidence* by Race/Ethnicity in Fresno County – 2010-2022



NHPI = Native Hawaiian Pacific Islander

Figure 10. Percent of TB Cases by Race/Ethnicity in Fresno County – 2016-2022

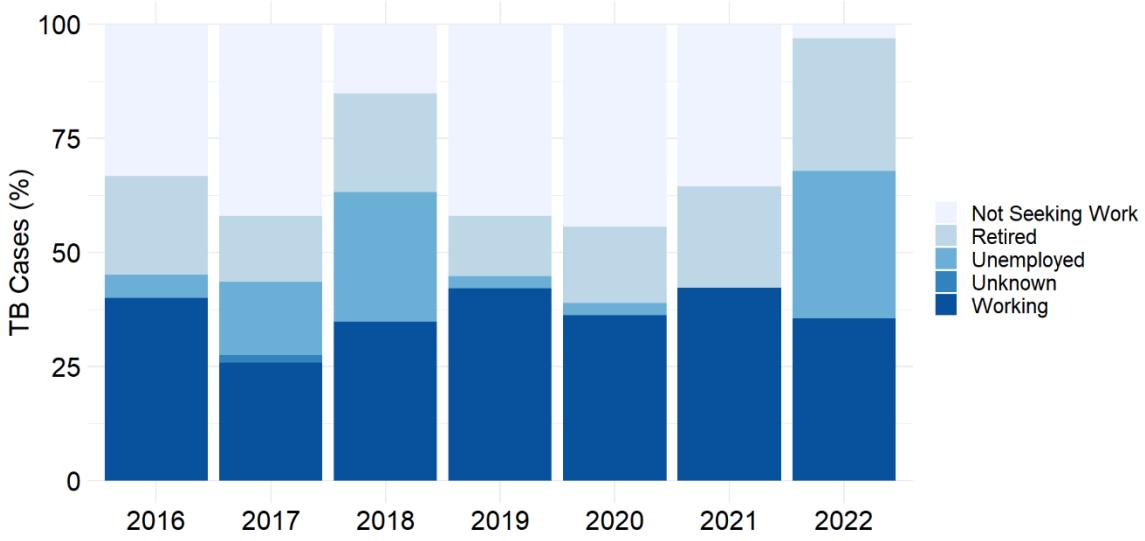


NHPI = Native Hawaiian Pacific Islander

Occupational Status in Fresno County

Figure 11 shows the occupational status of those with TB disease in Fresno County during 2022. Most cases, 20 (64.5%), were not employed because they were not seeking work, unemployed, or retired. Those with a TB diagnosis who were employed represent 35.5% of cases.

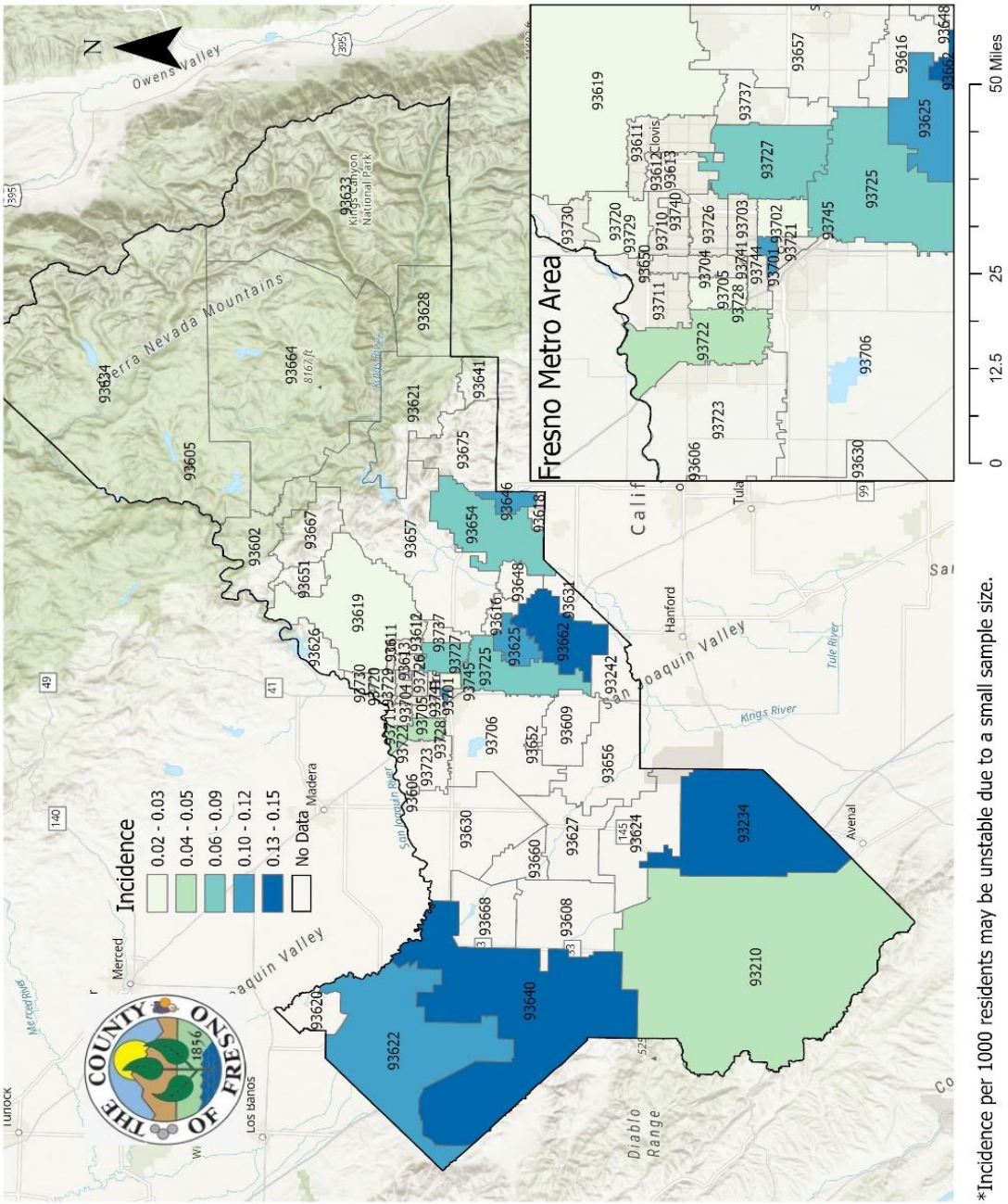
Figure 11. Occupational Status of TB Cases in Fresno County – 2016-2022



Geographic Distribution in Fresno County

Figure 12 shows the geographic distribution of TB cases within Fresno County by zip code. During 2022, the highest incidence of TB was located in zip codes: 93234, 93640, 93662, 93625 and 93622 (Figure 12).

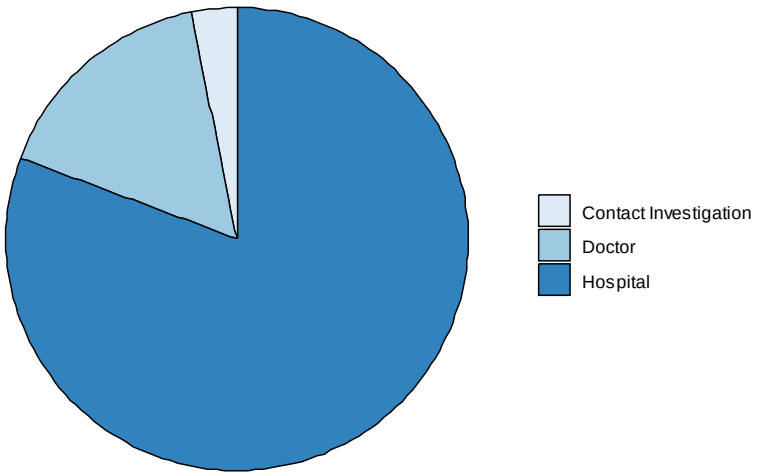
Figure 12. TB Incidence by Zip Code per 1000 Population in Fresno County-2022*



Case Referral by Source in Fresno County

Cases of TB were identified and referred to the Fresno County Department of Public Health for treatment from different sources. During 2022, referral sources for TB cases were: hospitals, doctors, and contact investigations. (Figure 13).

Figure 13. Referral Sources for TB Patients in Fresno County – 2022

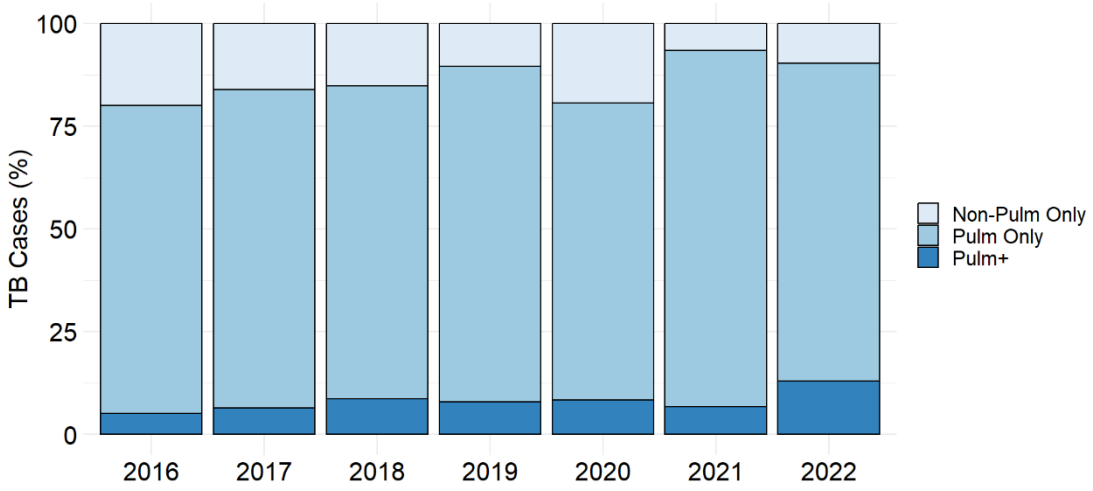


Pathology and Organism Characteristics in Fresno County

Infection Location

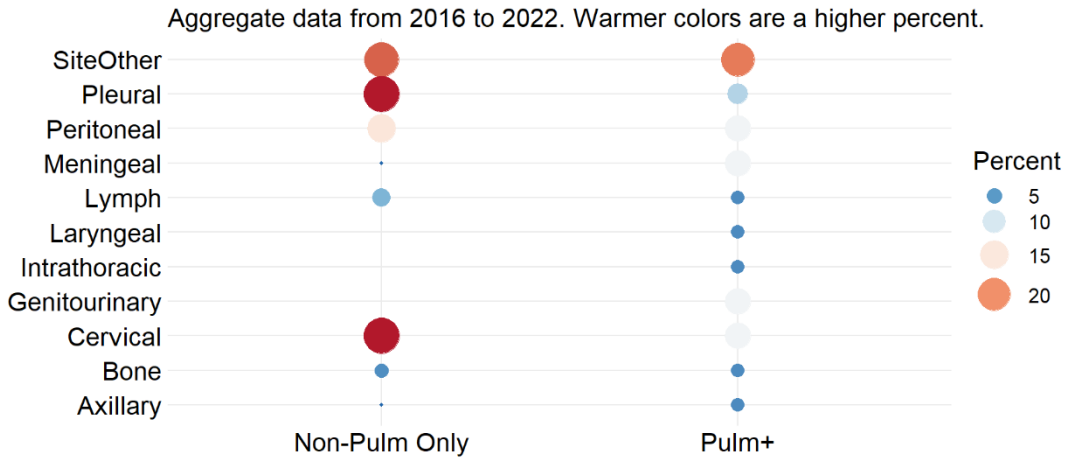
During 2022, 28 (90.3%) patients had lung involvement, of which 24 (77.4%) had lung involvement only (Figure 14). Pulmonary infection combined with infection in meningeal, peritoneal, and pleural tissues occurred in less than 15 patients (Data not shown). Extrapulmonary infections also occurred in less than 15 patients and were found in meningeal, peritoneal, and cervical tissues (Data not shown). Figure 15 shows the distribution of extrapulmonary TB infections using aggregate data from 2016 to 2022.

Figure 14. Pulmonary versus Extrapulmonary TB in Fresno County – 2016-2022*



*Pulm+ infections occur in both the lung and other tissues, while Non-Pulm Only infections occur outside the lung.

Figure 15. Infection Location for Extrapulmonary TB in Fresno County – 2016-2022*

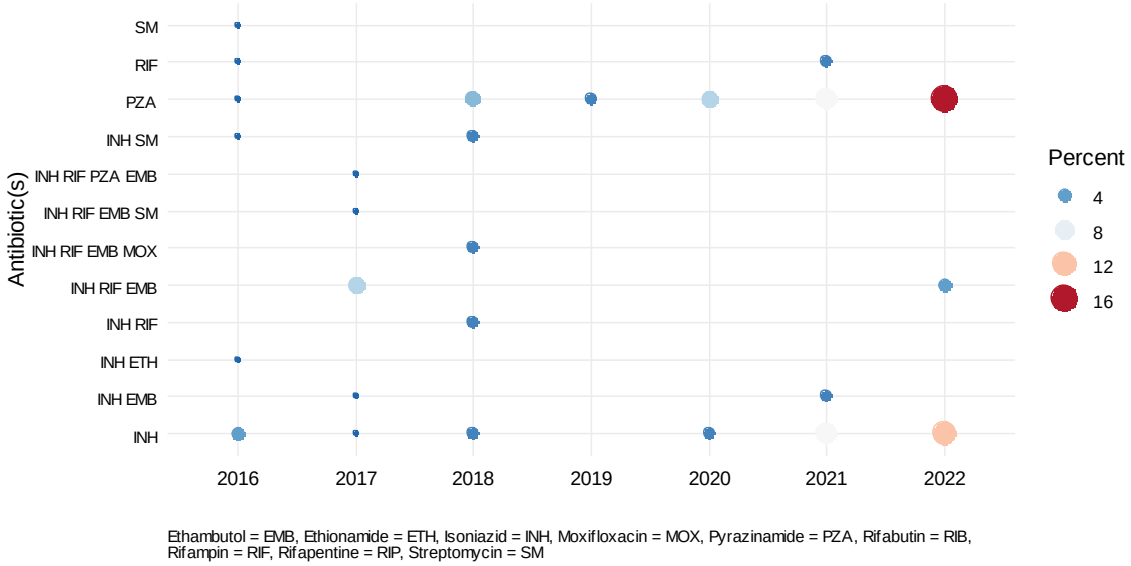


*Pulm+ infections occur in both the lung and other tissues, while Non-Pulm Only infections occur outside the lung.

Drug Resistance

Culture positive results were obtained from 17 (54.8%) of the 31 TB patients. No phenotypic drug resistance was observed among culture positive cases with initial drug susceptibility results. Initial phenotypic drug resistance to isoniazid, pyrazinamide, rifampin, and ethambutol was observed in cases that were not culture positive. The initial phenotypic drug resistance profile of TB cases from 2016-2022 is shown in Figure 16.

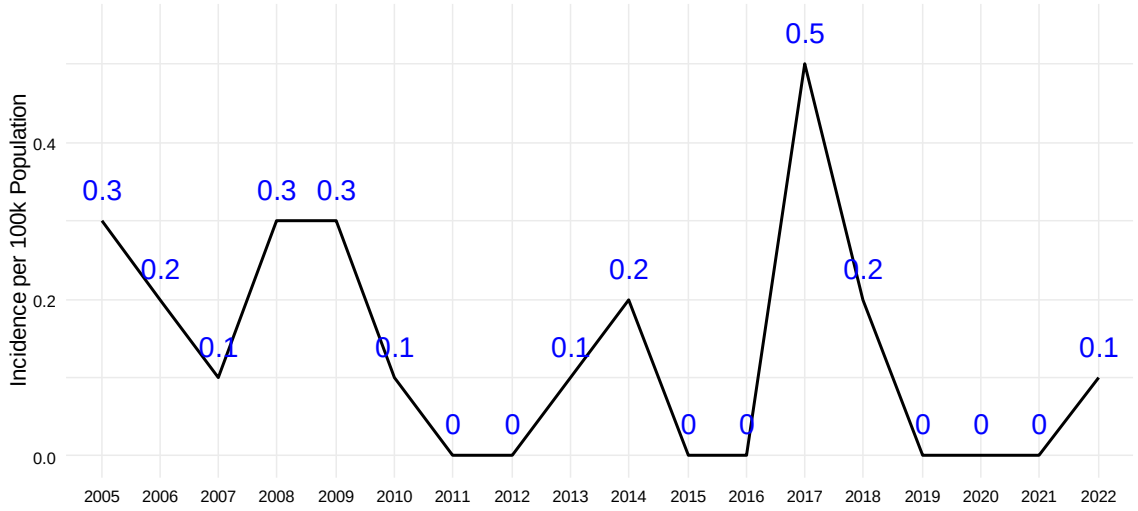
Figure 16. Initial Phenotypic Drug Resistance as a Percentage of TB Cases Tested for Initial Drug Resistance by Year in Fresno County – 2016-2022



Multidrug-Resistant Tuberculosis (MDR-TB)

Multidrug-resistant TB (MDR-TB) is resistant to the strongest two primary anti-tuberculosis medications (Isoniazid and Rifampin), and extensively drug resistant TB (XDR-TB) organisms are resistant to these medications plus at least two of the principal secondary medications. Patients with XDR-TB have few treatment options because the drugs most effective against TB are ineffective against their disease. In 2022, the incidence of initial MDR-TB per 100,000 population was 0.1, and there were no XDR-TB cases in Fresno County (Figure 17).

Figure 17. Incidence of Initial MDR-TB* in Fresno County – 2005-2022

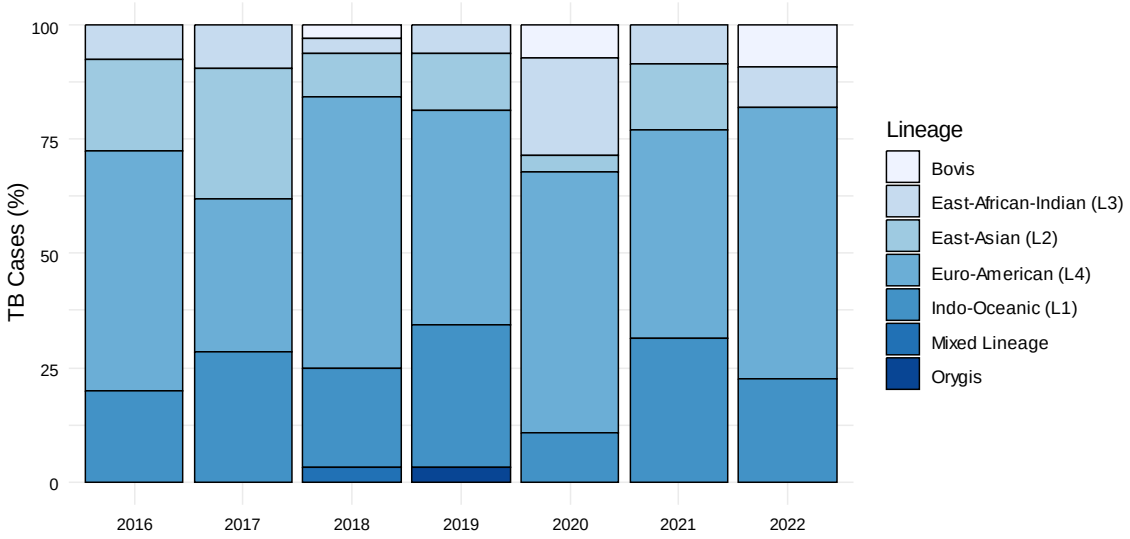


*Multidrug-resistant TB (MDR-TB) is resistant to the strongest two primary anti-tuberculosis medications (Isoniazid and Rifampin).

Genotype

The TB program can use genetic all links between TB cases to investigate and stop common sources of transmission. Figure 18 shows the proportion of each lineage in TB cases sent for genotyping from 2016-2022. During 2022, 22 (71.0 %) cases were genotyped and composed of four lineages: East-African-Indian, Euro-American, Indo-Oceanic, and Bovis.

Figure 18. TB Lineage by Year in Fresno County – 2016-2022



Contributing Risk Factors and Comorbidities in Fresno County

Risk Factors

The proportion of TB cases by risk factor and nativity from 2017 to 2022 is in Table 1. During 2022, 30 (96.8%) of the 31 TB cases had at least one or more underlying risk factor from Table 1 that increased risk for TB infection or progression of infection to disease whether it be occupational, social, or medical.

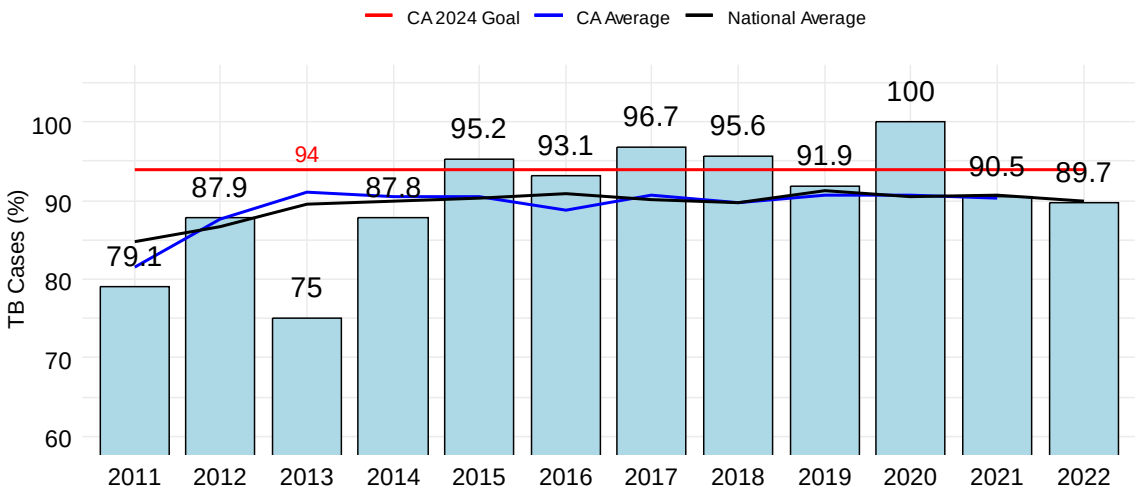
Table 1. Percent of TB Cases by Risk Factor and Nativity in Fresno County – 2017-2022

Risk Factor	Foreign Born %	US Born %
Alcohol Abuse	26 (12.9)	6 (12.2)
Correctional Facility Employee	0 (0.0)	0 (0.0)
Correctional Facility Resident	0 (0.0)	2 (4.0)
Diabetes	69 (33.3)	3 (6.0)
End Stage Renal Disease	7 (3.4)	2 (4.0)
Health Care Worker	7 (3.4)	1 (2.0)
HIV Positive	6 (3.1)	1 (2.3)
Homeless	5 (2.4)	5 (10)
Immunosuppression	9 (4.4)	6 (12.0)
Infectious Contact	5 (2.4)	8 (16.0)
Injection Drugs	2 (1.0)	2 (4.1)
Long Term Care Facility Resident	1 (0.5)	2 (4.0)
LTBI Incomplete Rx	4 (2.2)	1 (2.1)
MDR Contact	0 (0.0)	1 (2.1)
Migrant/Seasonal Worker	25 (12.1)	2 (4.0)
Missed Contact	0 (0.0)	0 (0.0)
Non-Injection Drugs	9 (4.4)	4 (8.2)
Post Organ Transplant	0 (0.0)	0 (0.0)
Previous TB Dx	15 (7.7)	2 (4.0)
TNF Antagonist Rx	0 (0.0)	0 (0.0)

HIV Testing

Of the 31 TB patients in 2022, 29 were eligible for HIV testing and of the eligible patients 26 (89.7%) completed testing (Figure 19).[12] Cases of TB are excluded from testing when they are very young or very old and do not have risk factors for HIV.

Figure 19. Patients with Known *HIV Status in Fresno County – 2011-2022



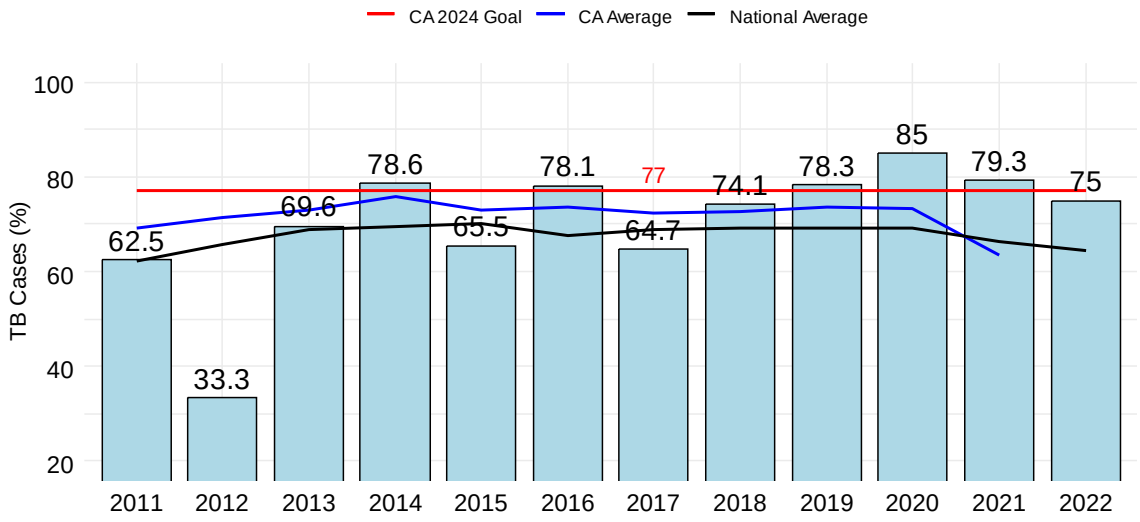
*HIV Status is Either Positive or Negative

Treatment Outcomes in Fresno County

Sputum Culture Conversion

Of the 31 cases of TB in Fresno County during 2022, 16 had positive sputum culture results at the time of treament initation. After 60 days of treament, 12 (75.0%) patients had sputum-culture negative results indicating they were no longer contagious for TB (Figure 20).[12]

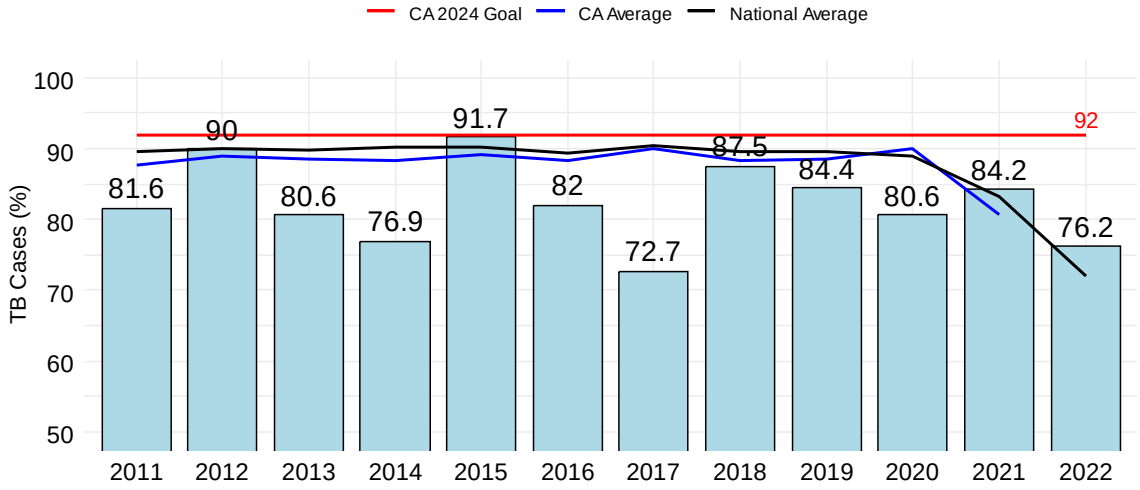
Figure 20. Sputum Culture Conversion Within 60 Days in Fresno County – 2011-2022



Active Tuberculosis Treatment Completion

Out of the 31 TB patients, 22 (71.0%) were eligible to complete treatment. Patients became ineligible to complete therapy if they died before treatment initiation or completion, had to stop treatment due to medication side effects, or moved outside Fresno County. As of the publication of this report, 18 (81.8%) of the eligible patients have finished treatment. Those patients that did not finish their TB treatment were lost to follow-up, refused to complete their treatment, or are completing therapy currently. During 2022, 21 (67.7%) of the 31 TB patients were eligible to complete their treatment within a 12 month period as defined by CDC criteria from the National Tuberculosis Indicators Project (NTIP).[12] Examples of ineligible patients include those with rifampin-resistant TB, meningeal TB, TB in the skeletal system, TB in the central nervous system, and children less than 15 years old with disseminated TB. Patients who moved out of the U.S within 366 days of initiating treatment are also ineligible to complete treatment within 12 months. Of those 21 patients, 16 (76.2%) completed their treatment within the 12 month period (Figure 21).[12] Delays or intermittent interruptions in treatment can result from factors such as: MDR-TB, patient non-compliance, underlying health conditions, and adverse effects of medication.

Figure 21. TB Patients Completing Treatment within 12 Months* in Fresno County – 2011-2022

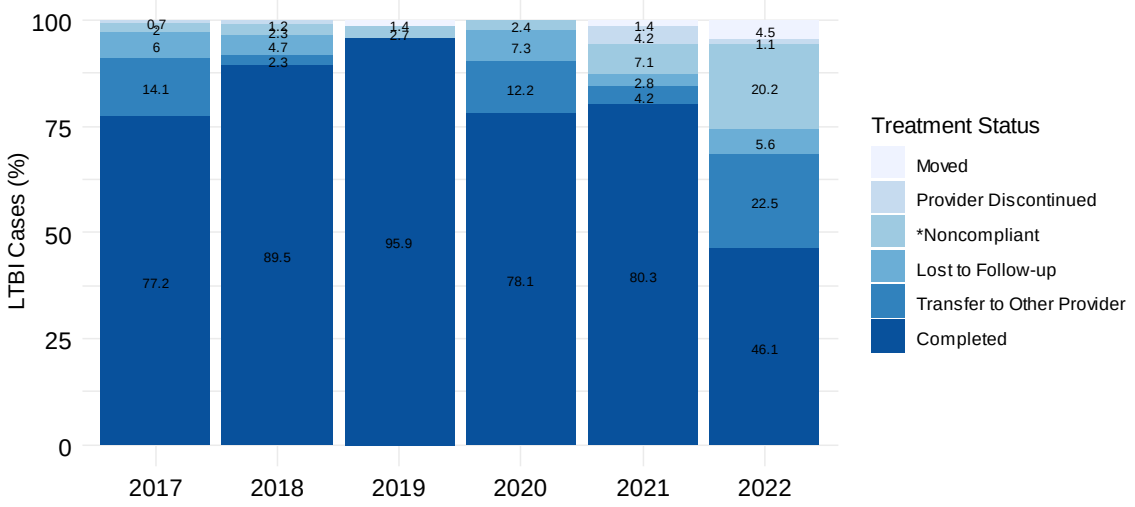


*For patients with TB in which 12 months or less of treatment was indicated per NTIP criteria.

Latent* Tuberculosis *(LTBI) Treatment

Someone with latent tuberculosis (LTBI) has a TB infection, but their immune system suppresses the TB bacteria, so they are asymptomatic. Without treatment, those with LTBI are at risk for developing active TB in the future. In California, about 80% of active TB cases result from patients with untreated LTBI.[10] The Fresno County Department of Public Health TB Control Program uses different LTBI treatment regimens depending on provider judgment and the availability of medication. Common treatment plans for LTBI patients in Fresno County include: once-weekly isoniazid-rifapentine for 12 weeks (3HP), rifampin daily for 4 months (4R), isoniazid-rifampin daily for three months (3HR), and isoniazid for either 6 or 9 months taken daily or twice weekly (6H/9H). In 2022, 89 patients were eligible for LTBI treatment with the TB Control Program and 46.1% (n=41) of these patients completed their treatment within the program. Patients did not complete their treatment within the TB program during 2022 because they completed their treatment with another provider 22.5% (n=20), were noncompliant with therapy 20.2% (n=18), were lost to follow-up 5.6% (n=5), moved away from the county 4.5% (n=4), or had their treatment discontinued due to medical reasons 1.1% (n=1). (Figure 22).

Figure 22. LTBI Treatment Status in Fresno County – 2017-2022



*Patient chose to not start or finish treatment.

Contact Investigation in Fresno County

During 2022, 7 (22.5%) of the 31 TB cases were AFB smear-positive and all these cases had contacts elicited for investigation. Out of the 30 AFB smear-positive contacts elicited, 29 (96.7%) of these contacts were examined for TB infection (Figure 23).[12] Out of those examined in 2022, 8 (27.6%) were discovered to have LTBI infection and 7 (87.5%) of these patients began treatment (Figure 24).[12] Treatment completion for the AFB Smear+ contacts with LTBI is available for years prior to 2022 (Figure 25).[12]

Figure 23. Contacts to AFB Smear+ Cases Examined for TB in Fresno County – 2011-2022

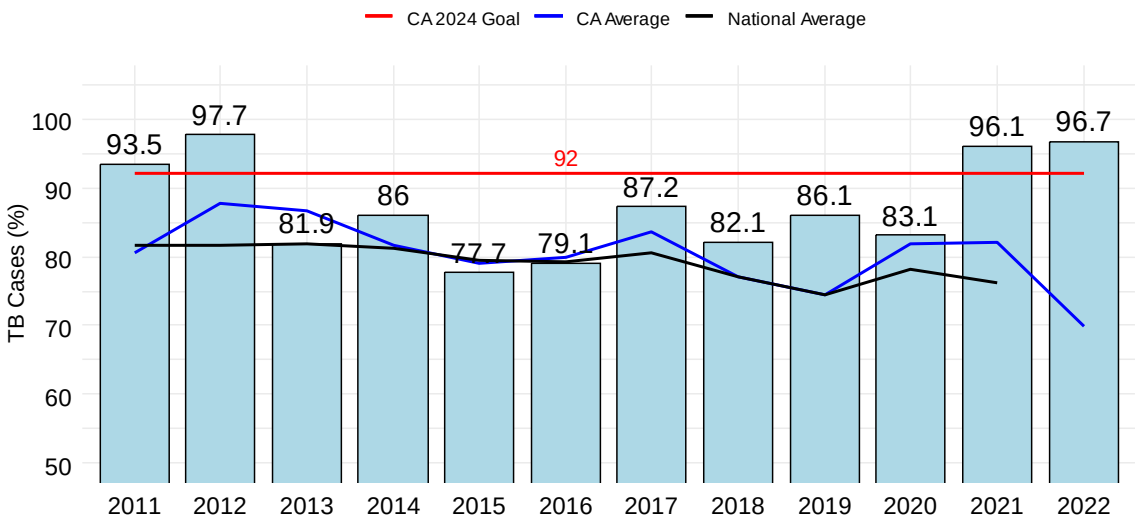


Figure 24. AFB Smear+ Contacts Who Started LTBI Treatment in Fresno County – 2011-2022

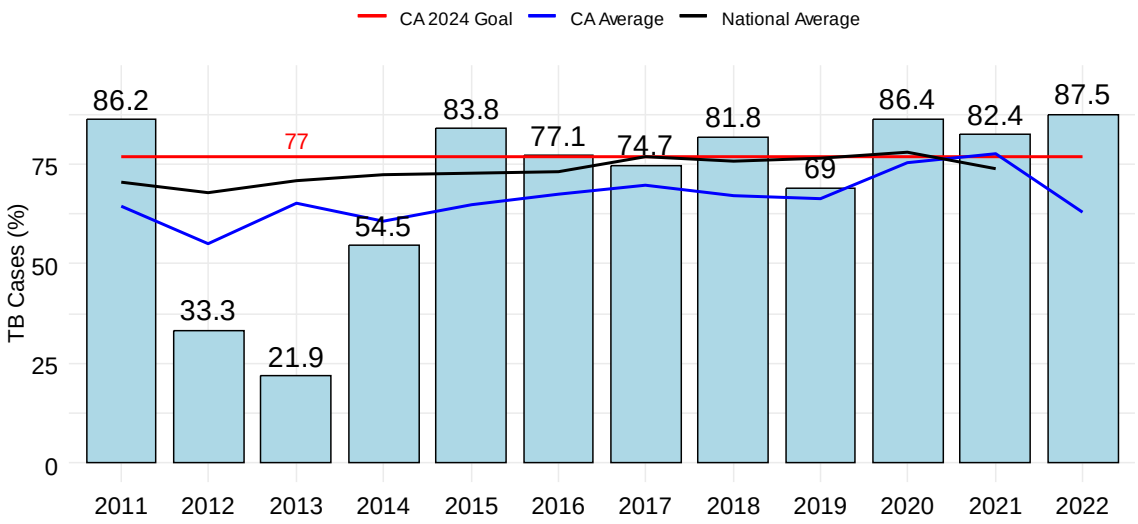
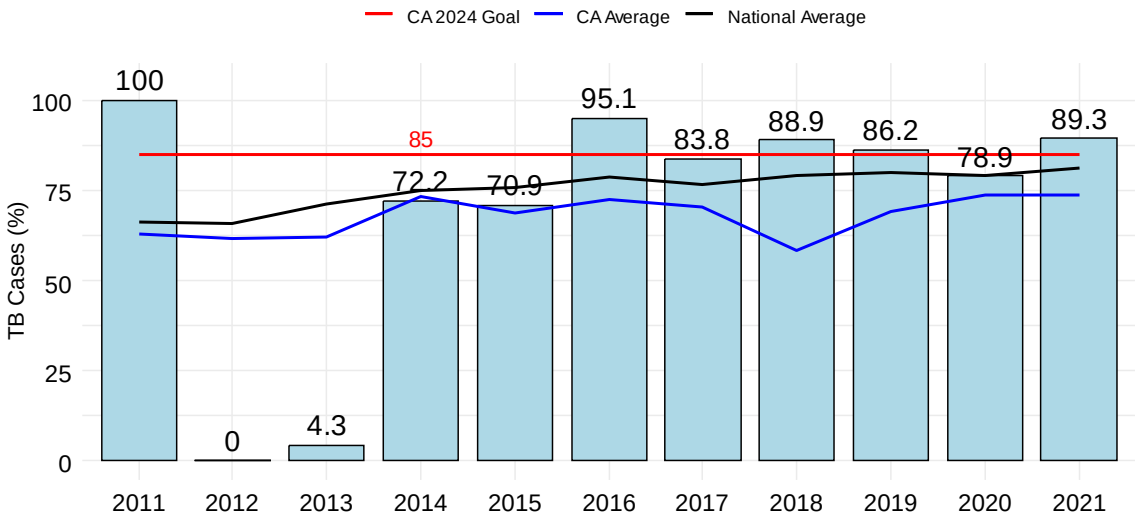


Figure 25. AFB Smear+ Contacts Who Completed LTBI Treatment in Fresno County – 2011-2021



Public Health Strategies to Control, Prevent, and Eliminate Tuberculosis

In 2022, the Fresno County Department of Public Health (FCDPH) TB Control Program provided treatment, contact investigation, and follow-up for all the 31 newly diagnosed active TB cases. The TB program staff continued to simultaneously provide care for patients diagnosed prior to 2022 who had not yet completed treatment (standard treatment regimens are 6-12 months; drug resistant TB patients may be treated for two years, and all treated patients require at least monthly visits). To ensure TB medication is taken correctly, department staff visit pulmonary TB patients daily to observe them take their medications; this is also known as Direct Observed Therapy (DOT).

Strategies to Control, Prevent, and Eliminate Tuberculosis Include:

1- Finding and adequately treating people that have active disease.
2- Identifying individuals who have been exposed to someone with TB disease, evaluating them for LTBI or active TB disease, and treating them if they have either of these.
3- Screening individuals for TB infection that are known to be at higher risk for infection with TB or at higher risk for developing TB disease if infected.
4- Applying control measures in high-risk settings.

The FCDPH TB Control Program identifies and treats TB disease, identifies and evaluates exposures to TB, and offers treatment if needed. FCDPH also screens certain high risk populations, and assists the public with the application of control measures in high risk environments.
Title 17 of California Code of Regulations requires that notification be given to the county health department of all diagnosed or suspected cases of TB by telephone or fax within one working day of identification. California Health and Safety Code 121362 also require that providers treating people with active TB report to the local health officer any pertinent information the health officer requests.

Additional Information Available

If you have any questions regarding TB infection, the disease, or the control of TB in Fresno County please contact our FCDPH Community Liaison Nurse at 559-600-3413.

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9. Tuberculosis Control Branch, Provisional TB Data Tables, 2022. California Department of Public Health, Richmond, CA.

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11. CDC. Basic TB Facts. https://www.cdc.gov/tb/topic/basics/default.htm. Published 3/20/2016. Accessed 9/6/2023.

12. National Tuberculosis Indicators Project (NTIP) Division of Tuberculosis Elimination National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention Centers for Disease Control and Prevention, Atlanta, Georgia, USA 30329

Technical Notes

Population Data

Population data used to calculate incidence comes from the following sources:

- California Department of Finance. Demographic Research Unit. Report P-2D: Population Projections by Total Hispanic and Non-Hispanic Race, California Counties, 2010-2060 (Baseline 2019 Population Projections; Vintage 2020 Release). Sacramento: California. March 2021.
- State of California, Department of Finance, E-6. Population Estimates and Components of Change by County — July 1, 2010–2020, December 2020.
- State of California, Department of Finance, Revised County Population Estimates and Components of Change by County, July 1, 2000-2010. Sacramento, California, December 2011.
- U.S. Census Bureau. (2020). 2016–2020 American Community Survey 5-Year Estimates by ZCTA for Fresno County.

Equations

$$Incidence = \frac{New\ Cases\ in\ Population\ at\ Specified\ Time}{Population\ at\ Risk} \times 100{,}000$$