

Tuberculosis Control Program Annual Report 2010

South Dakota Department of Health



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EPIDEMIOLOGICAL PROFILE OF TUBERCULOSIS IN SOUTH DAKOTA

During the last ten years, South Dakota averaged 15 cases of tuberculosis (TB) per year. During 2010, there were 15 cases of TB reported to the South Dakota Department of Health, which is a decrease of 3 cases from 2009. Figure 1 describes the 10-year trend of TB cases reported in South Dakota.

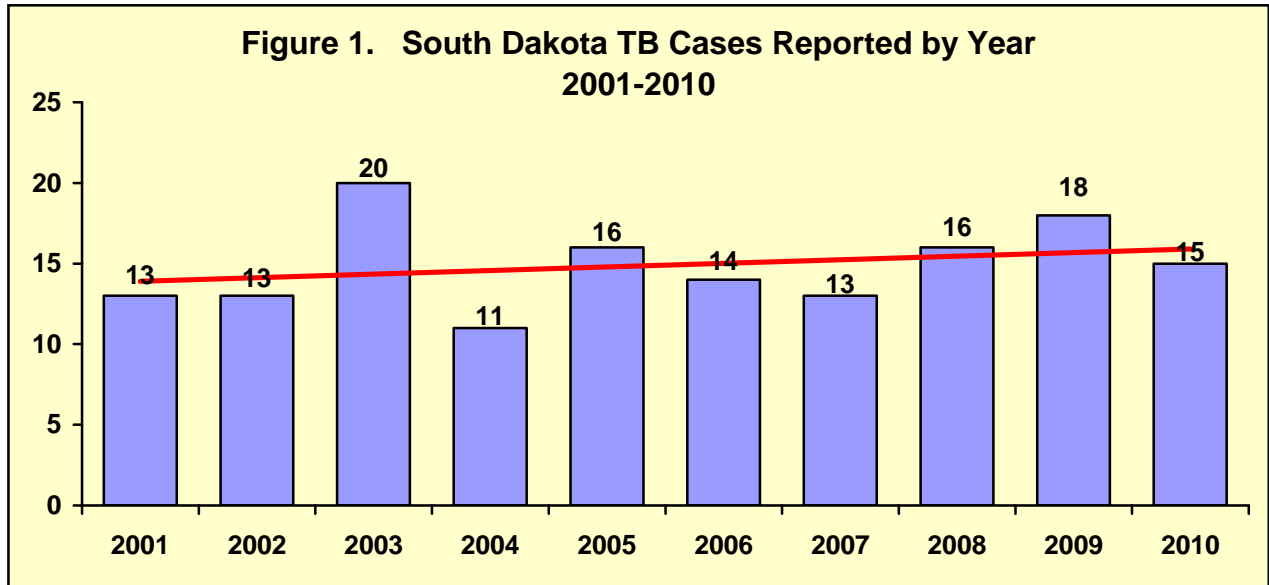
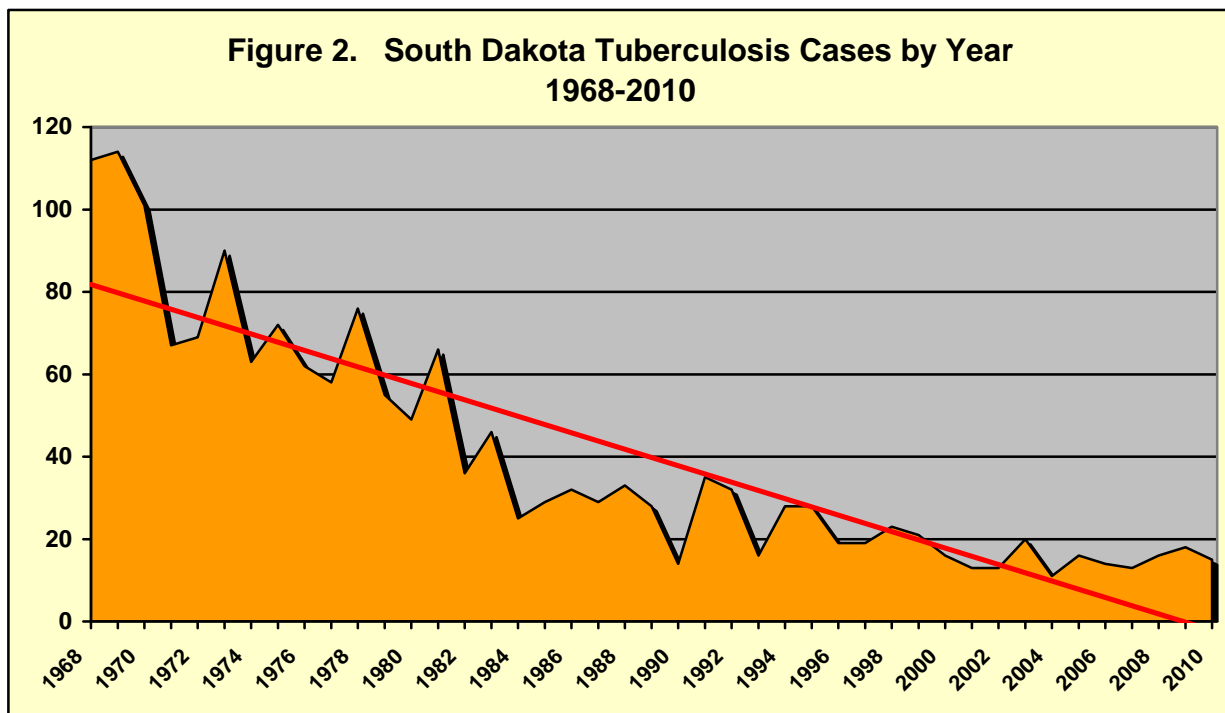


Figure 2 illustrates the historical decreasing trend of reported tuberculosis cases in South Dakota since 1968. This dramatic decrease is a result of mandatory reporting of suspected TB cases to the Department of Health along with case management, treatment and comprehensive contact investigations to ensure those exposed to tuberculosis receive prompt treatment and appropriate intervention efforts.



The most recent data available nationally and regionally is from calendar year 2009. Figure 3 provides a comparison of the TB case rate per 100,000 population for the United States as well as a regional comparison of South Dakota and our border states of North Dakota, Minnesota, Iowa, Nebraska, Wyoming and Montana. Please note that South Dakota has the second highest TB case rate behind Minnesota when comparing these 7 states.

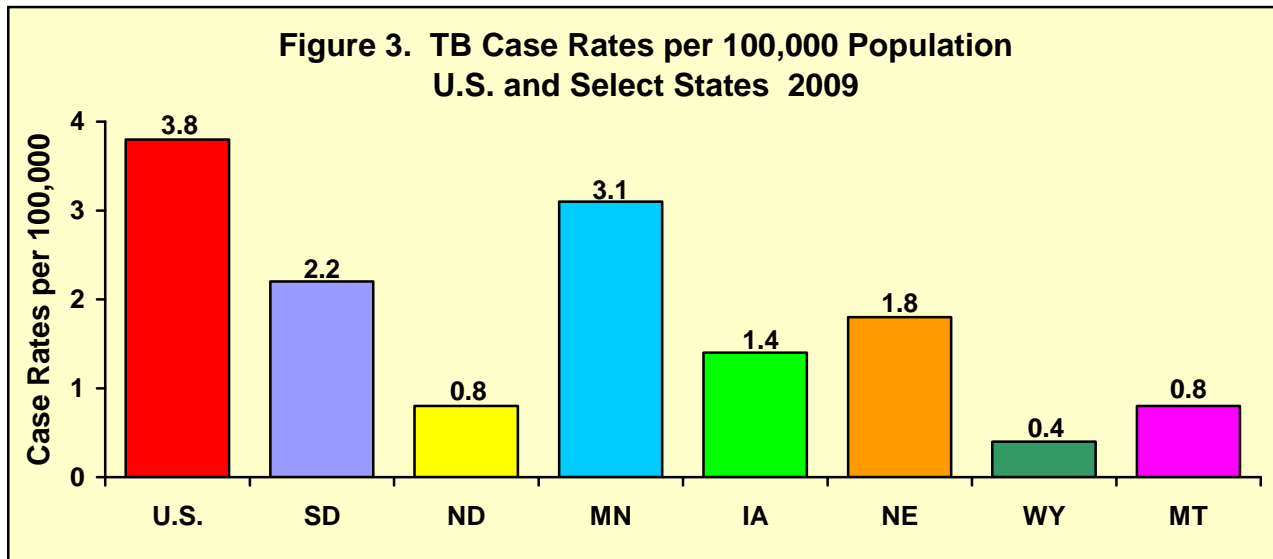
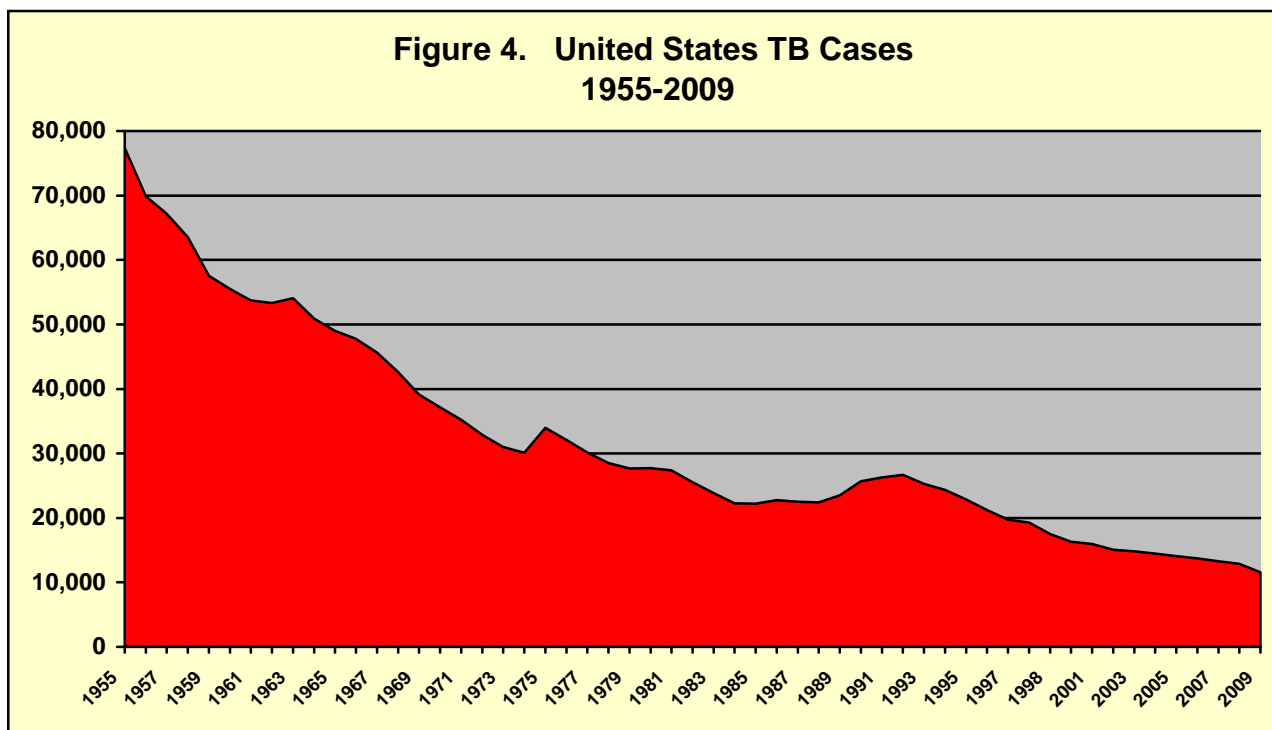


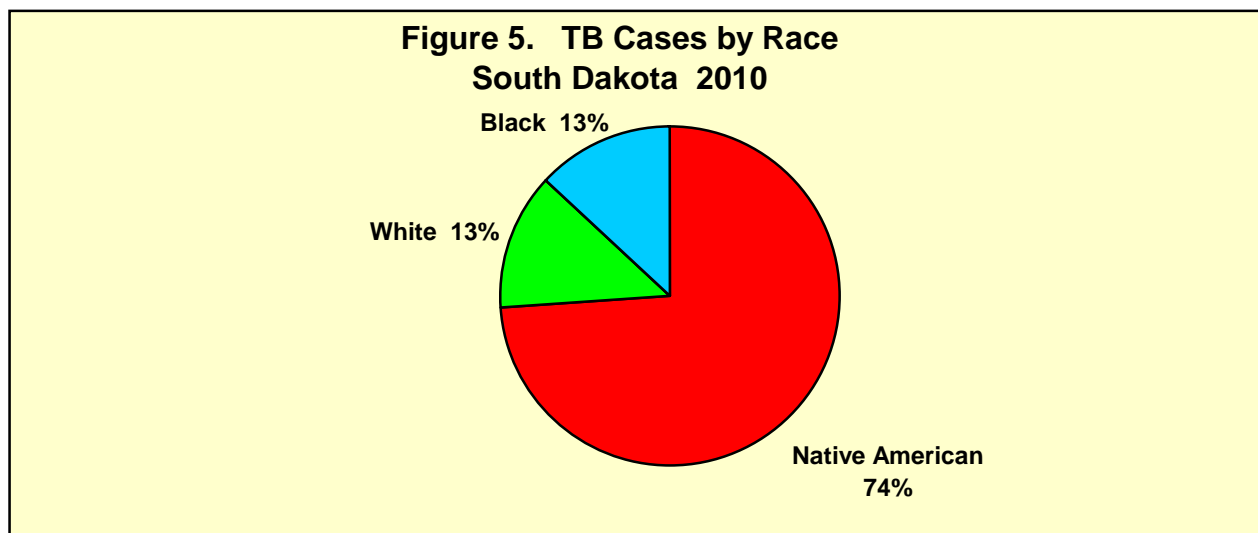
Figure 4 illustrates the historical trend of decreasing TB cases reported in the United States. In 2009 there were 11,545 TB cases reported in the US which was the lowest year on record, representing a 10.5% decrease from 2008. During 2009, 13 states reported increased case counts from 2008. The 4 states of California, Texas, New York and Florida accounted for 50% of the national case total. During 2009, 1.2% of the reported cases had primary multi-drug resistance which is defined as resistance to the TB medications of at least isoniazid and rifampin. During 2009, 59% of TB cases nationally were in foreign-born persons, the highest percentage ever reported.



Native Americans have historically represented the highest percentage of TB cases by race. This trend continued in 2010 with Native Americans contributing 74% of the total TB cases reported. Table 1 and Figure 5 provide information on TB cases by race in 2010.

**Table 1. TUBERCULOSIS CASES REPORTED BY SEX AND RACE
SOUTH DAKOTA 2010**

Race	Male	Female	Total	% of Cases
Native American	6	5	11	74%
White	1	1	2	13%
Black	0	2	2	13%
Asian	0	0	0	0%
Total	7	8	15	100%



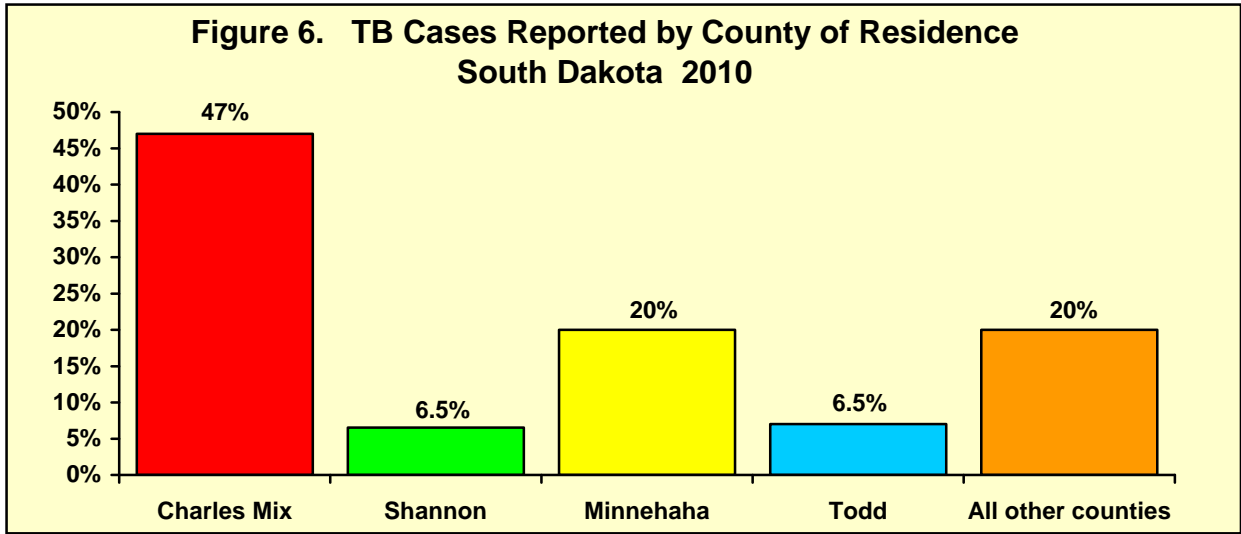
The TB incidence rate, which measures the number of TB cases per 100,000 population, is the best measure for determining the progress towards the elimination of TB in South Dakota. Historically, Native American TB case rates have dropped considerably while white cases have consistently remained low. The Black, Asian and other races mainly represent TB cases born outside of the United States who were diagnosed in South Dakota. Table 2 provides additional information on TB case rates for the last 6 years.

**Table 2. TUBERCULOSIS MORBIDITY INCIDENCE RATES
PER 100,000 BY RACE & YEAR SOUTH DAKOTA 2005-2010**

Race	2005	2006	2007	2008	2009	2010
US Case Rate (All Races)	4.8	4.6	4.4	4.2	3.8	Not available*
SD All Races	2.1	1.8	1.7	2.1	2.2	1.8
SD Native American	8.8	8.8	10.3	5.9	10.3	15.0**
SD White	0.6	0.1	0.4	0.1	0.9	0.3**
SD Black	48.4	64.5	32.3	161.3	64.5	24.6**
SD Asian	52.1	52.1	17.4	17.4	17.4	0.0
All Other SD Races	0.0	0.0	0.0	0.0	0.0	0.0

*2010 US case rate data is not yet available.

**2010 SD case rates by race were calculated with population estimates from 2010 census data.

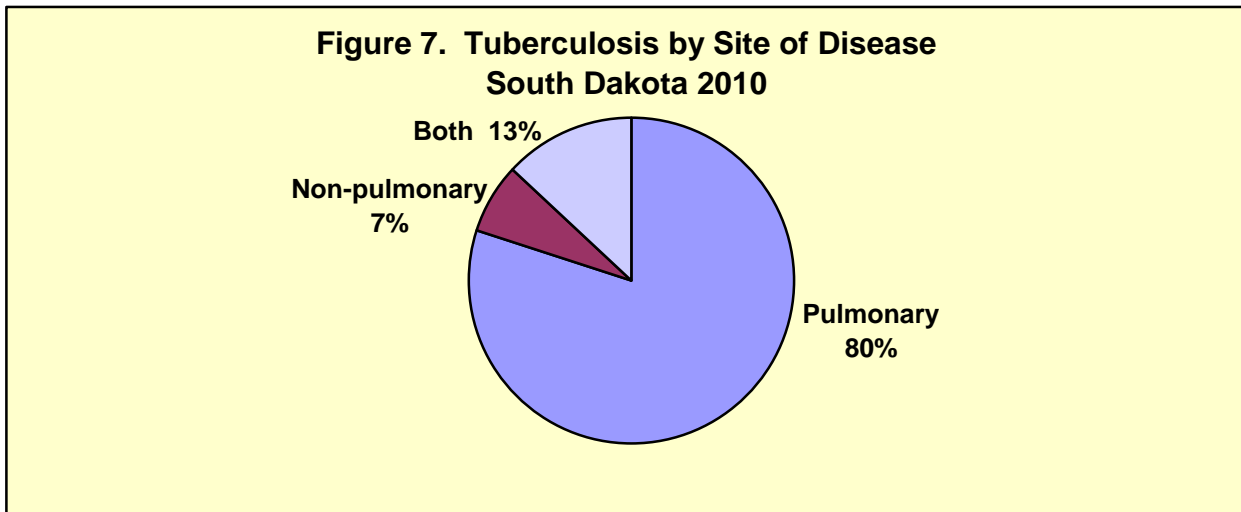


Tuberculosis cases in South Dakota have historically been located in a few geographic locations that consistently report the majority of TB cases. These include Minnehaha County which reports the highest number of foreign-born TB cases and Shannon, Todd and Pennington counties which report the highest number of Native American TB cases. Figure 6 and Table 3 provide additional information on the counties of residence of the TB cases in 2010.

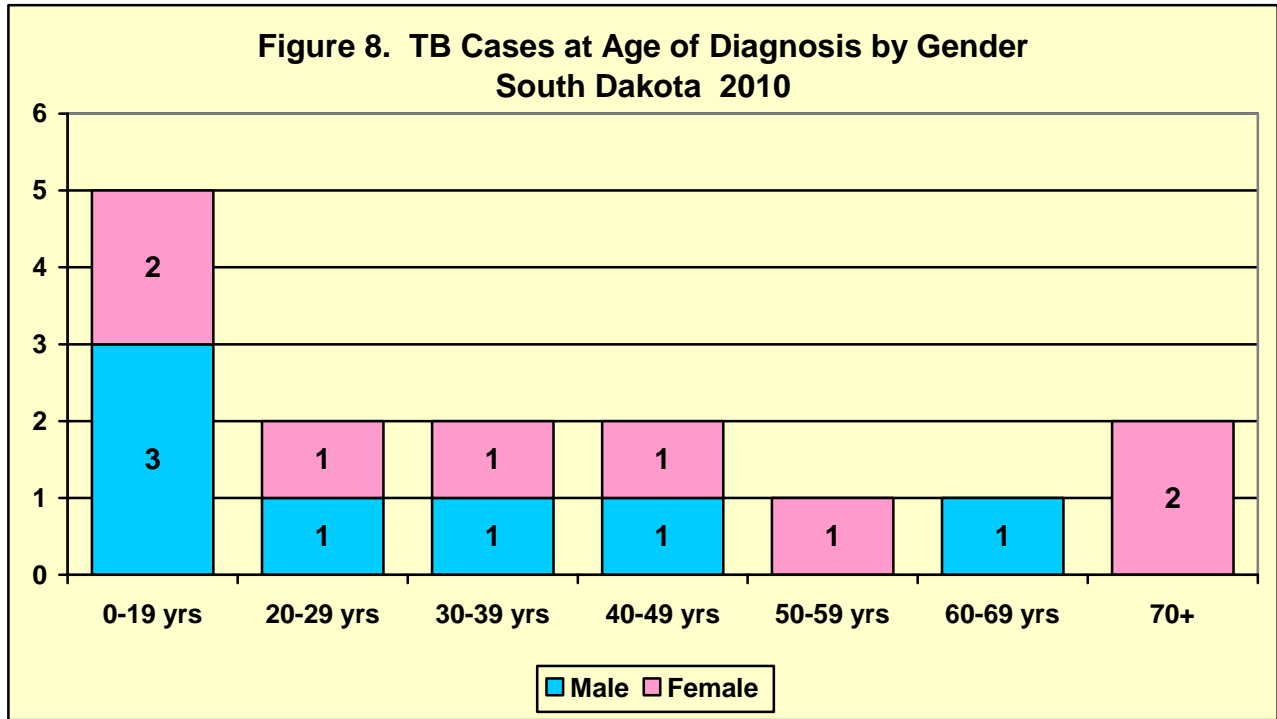
**Table 3. TB CASES REPORTED BY COUNTY OF RESIDENCE
SOUTH DAKOTA 2010**

County	# of TB Cases	County	# of TB Cases
Bennett	1	Minnehaha	3
Charles Mix	7	Shannon	1
Clay	1	Todd	1
Hanson	1		

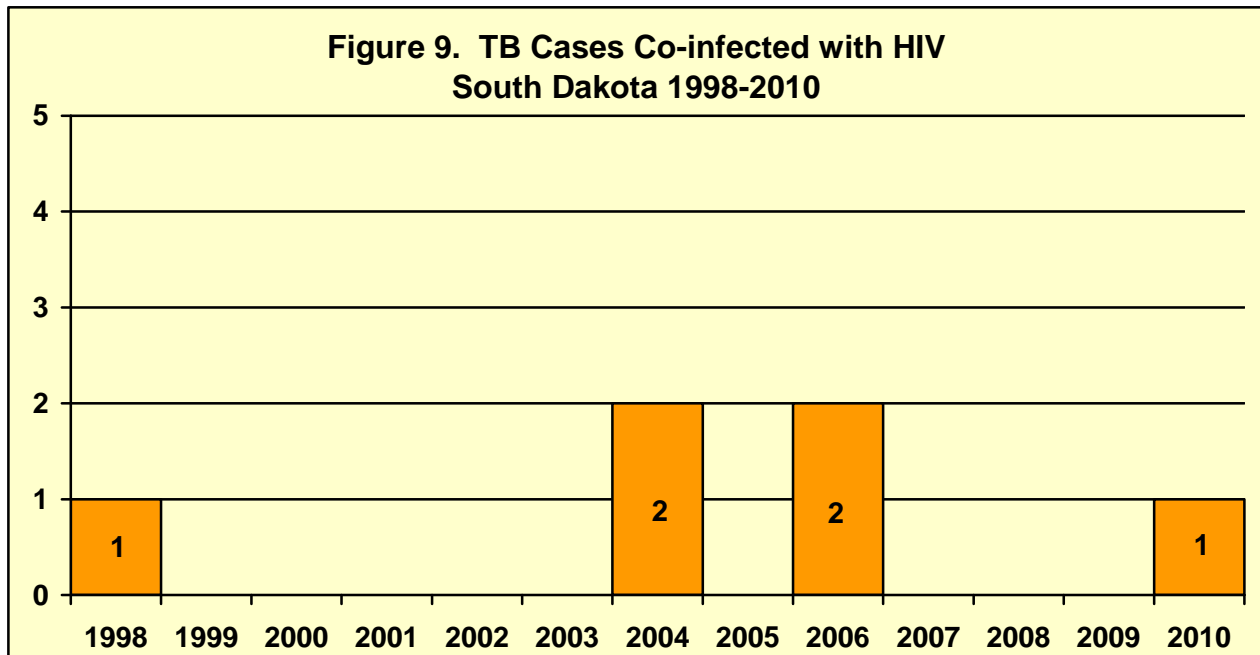
Tuberculosis remains primarily a pulmonary disease with approximately 85% of cases nationally reported as pulmonary disease and 15% as non-pulmonary disease. South Dakota has historically reported a higher percentage of non-pulmonary TB disease. In 2010 this trend continued with 3 cases (20%) reported as non-pulmonary disease or both pulmonary and non-pulmonary sites of disease as described in Figure 7. The non-pulmonary sites of disease in 2010 included TB reported in pleural fluid and lymph nodes.



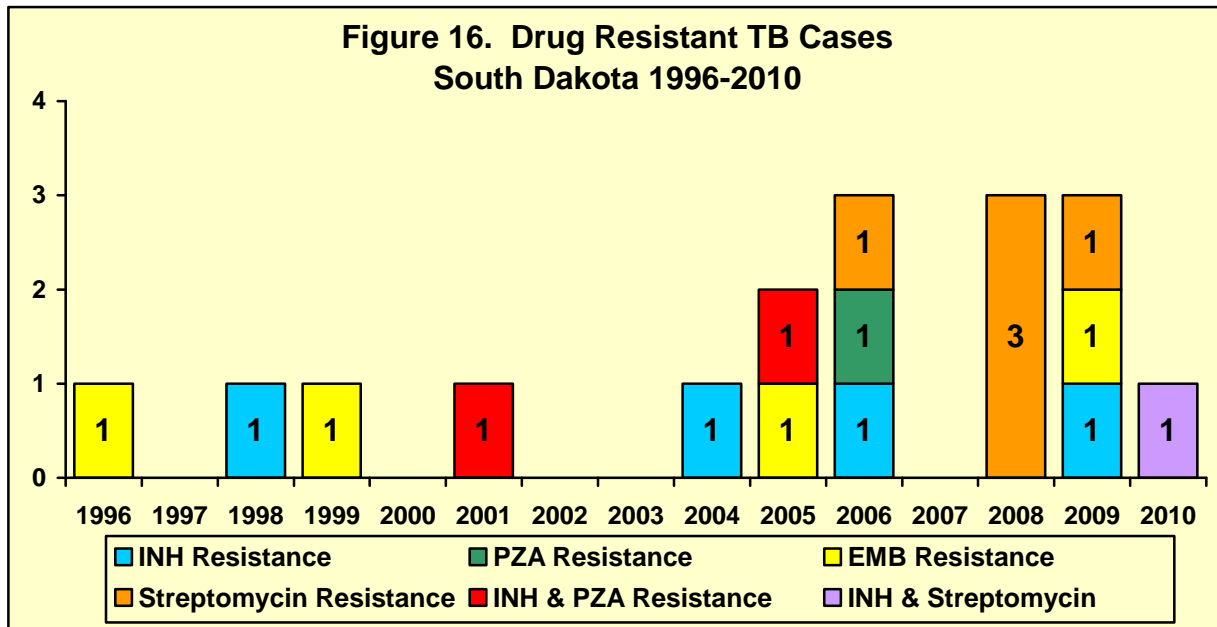
The average age of the TB case in 2010 was 34 years of age. This is a shift to younger patients as compared to 2009 when the average age was 45 years of age. There were 3 children less than 10 years of age reported during this time period. Figure 8 illustrates the age at diagnosis by gender for tuberculosis cases reported in 2010.



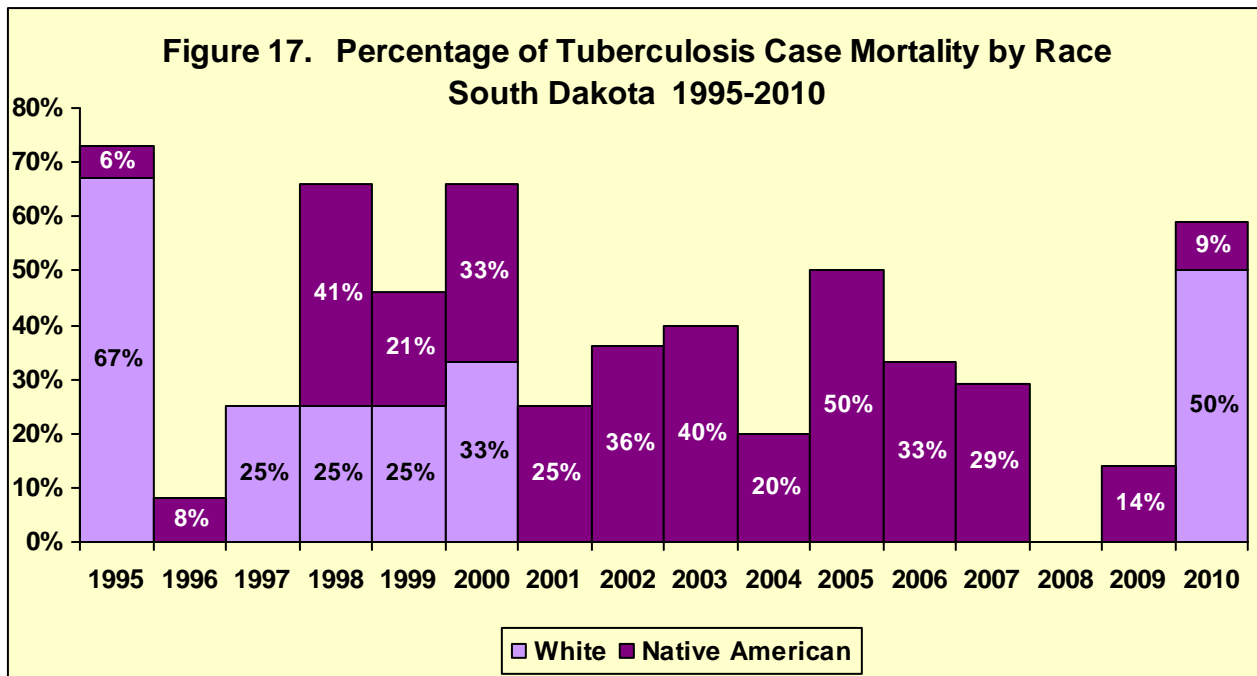
Co-infection with HIV is an important risk factor for the development of active TB. Because of this, all TB cases diagnosed in South Dakota aged 25-44 years of age are offered HIV testing. Co-infected TB cases require more monitoring for toxicity and are frequently treated with second line TB medications. Figure 9 describes the number of TB cases co-infected with HIV since 1998 documenting that HIV co-infected TB cases remain uncommon.



All culture positive TB cases are tested for drug resistance to first-line TB medications including isoniazid, rifampin, pyrazinamide, ethambutol and streptomycin. Multi-drug resistant TB (defined by CDC as resistance to at least INH and RIF) is a significant public health problem because of the difficulty in achieving a successful treatment outcome. Figure 16 describes drug resistant TB cases since 1996 illustrating that South Dakota most often has single drug resistant cases. No multi-drug resistant TB cases have been reported in South Dakota although the Department of Health has managed several MDR-TB cases reported in other states that have moved to South Dakota.



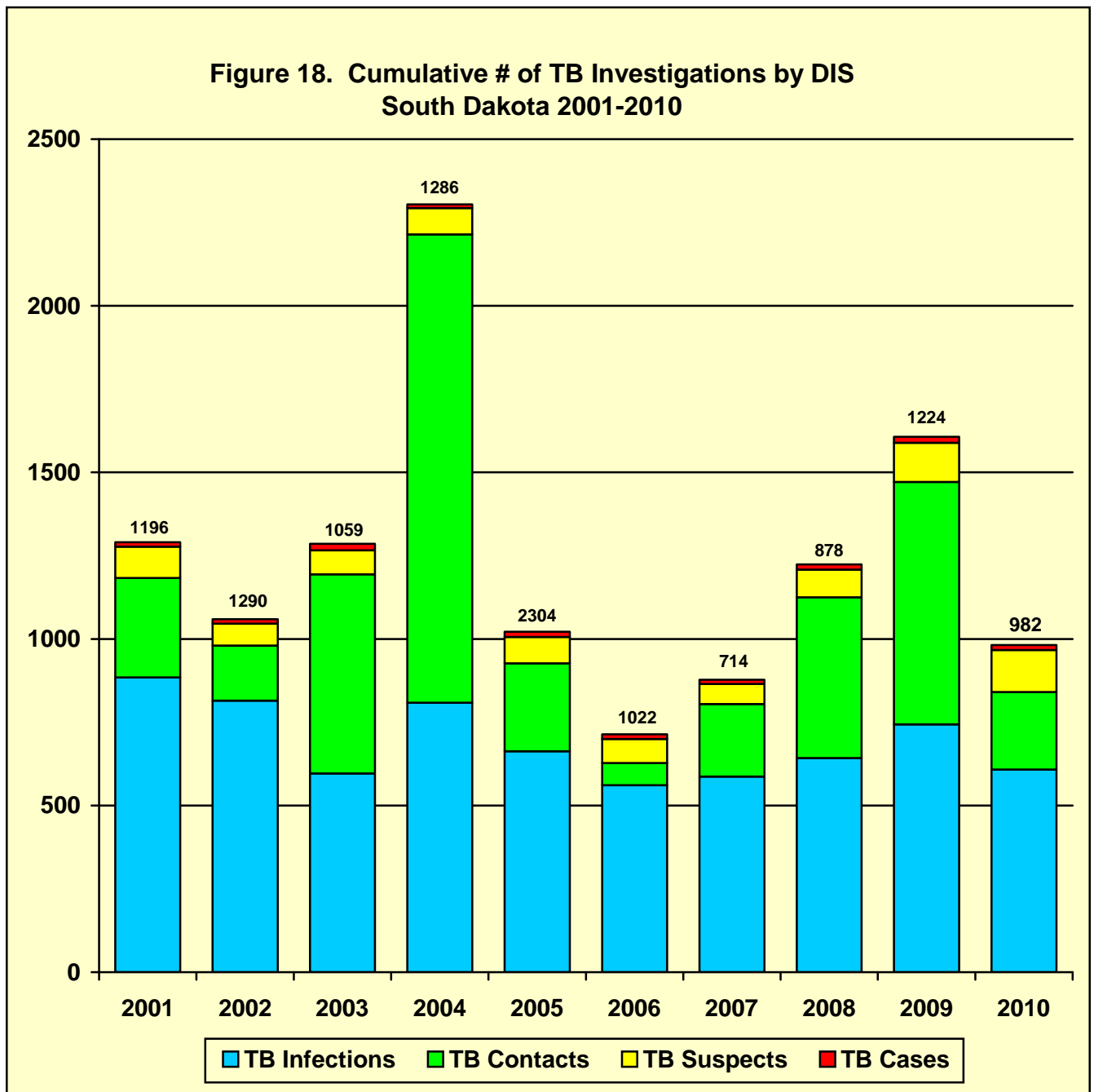
South Dakota has reported a higher than expected mortality rate during certain years, especially among Native American patients. Figure 17 describes the mortality rates by race since 1995 showing the higher trend among Native American cases. Mortality rates are calculated by the percentage of TB cases by race that die during the year of their diagnosis.



The workload in the TB Control Program consists of four categories of patients:

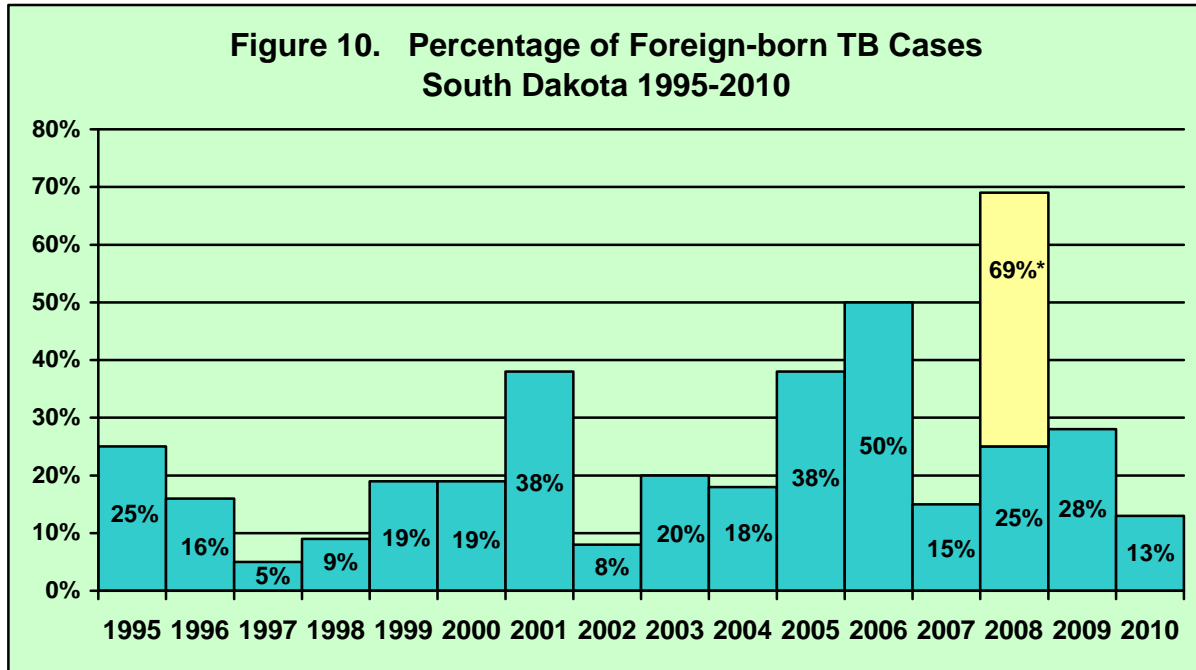
- 1) **TB cases** (persons diagnosed with active TB)
- 2) **TB suspects** (persons suspected of active TB with a pending diagnosis)
- 3) **TB contacts** (persons exposed to an infectious TB case)
- 4) **Latent TB infection** (persons reported with a positive TB skin test or positive IGRA test [interferon gamma release assay])

All of these conditions are reportable to the TB Control Program and are initiated for investigation. Disease Intervention Specialist (DIS) staff are responsible for ensuring appropriate investigation, treatment and follow-up of these individuals statewide. Figure 18 describes this cumulative caseload which is divided among 19 DIS staff illustrating that the active TB cases and suspect TB cases represent the smallest number of patients reported. TB contacts and patients with latent TB infection make up the greatest percentage of assigned workload for DIS staff within the TB Control Program.



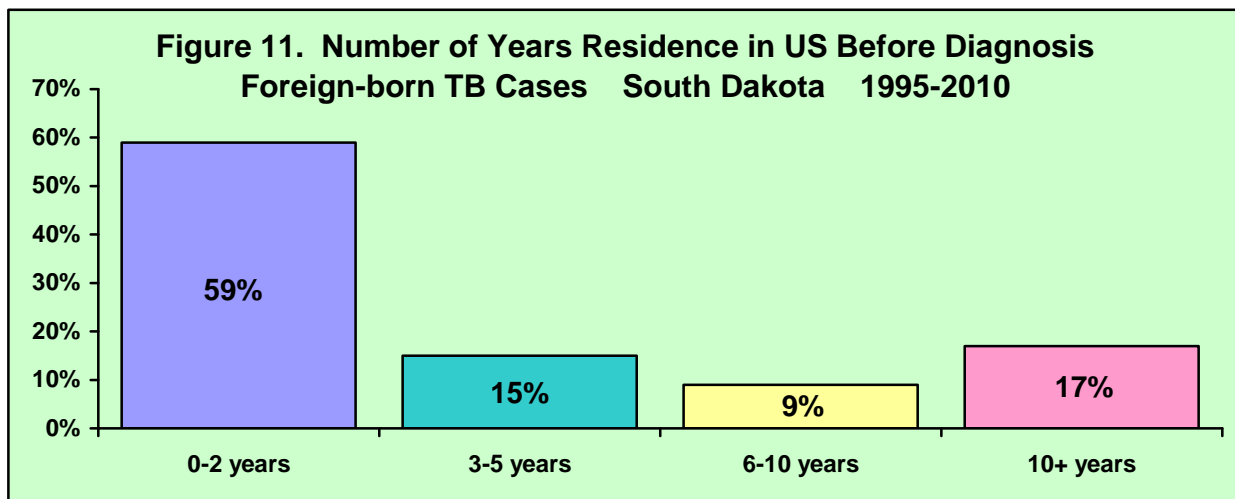
ANALYSIS OF FOREIGN-BORN TB CASES IN SOUTH DAKOTA

Tuberculosis cases who were born outside the United States continue to represent an important risk group in the United States as well as in South Dakota, however during 2010 this group decreased to 13% of the total cases reported. Figure 10 describes the percentage of foreign-born TB cases in South Dakota. US-born TB cases born to foreign-born parents is a relatively new TB risk factor which has been identified nationally. TB cases were first reported in this risk group in South Dakota in 2008 and are represented in Figure 10.

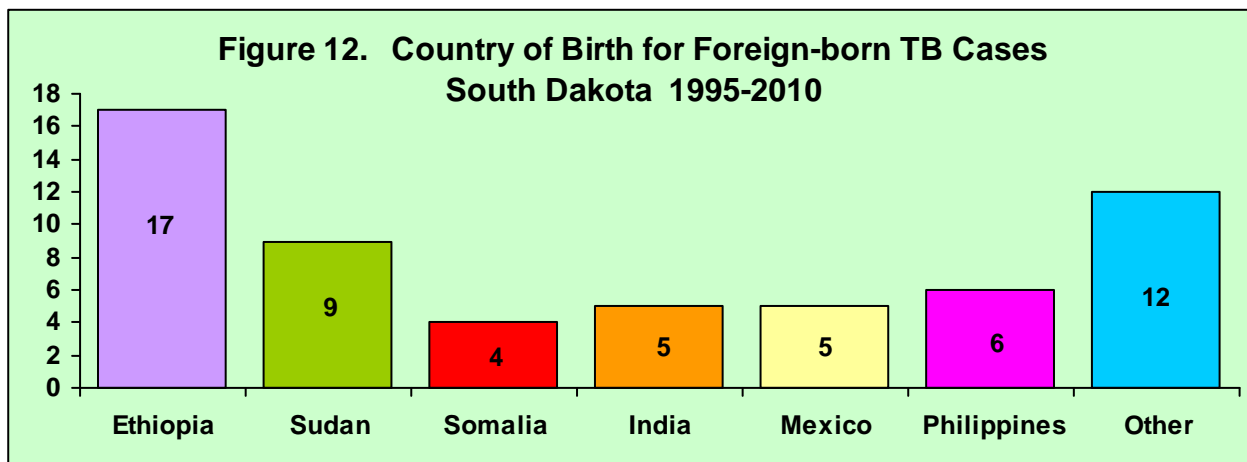


* In 2008, the 69% includes both foreign-born cases as well as US-born cases born to foreign-born parents.

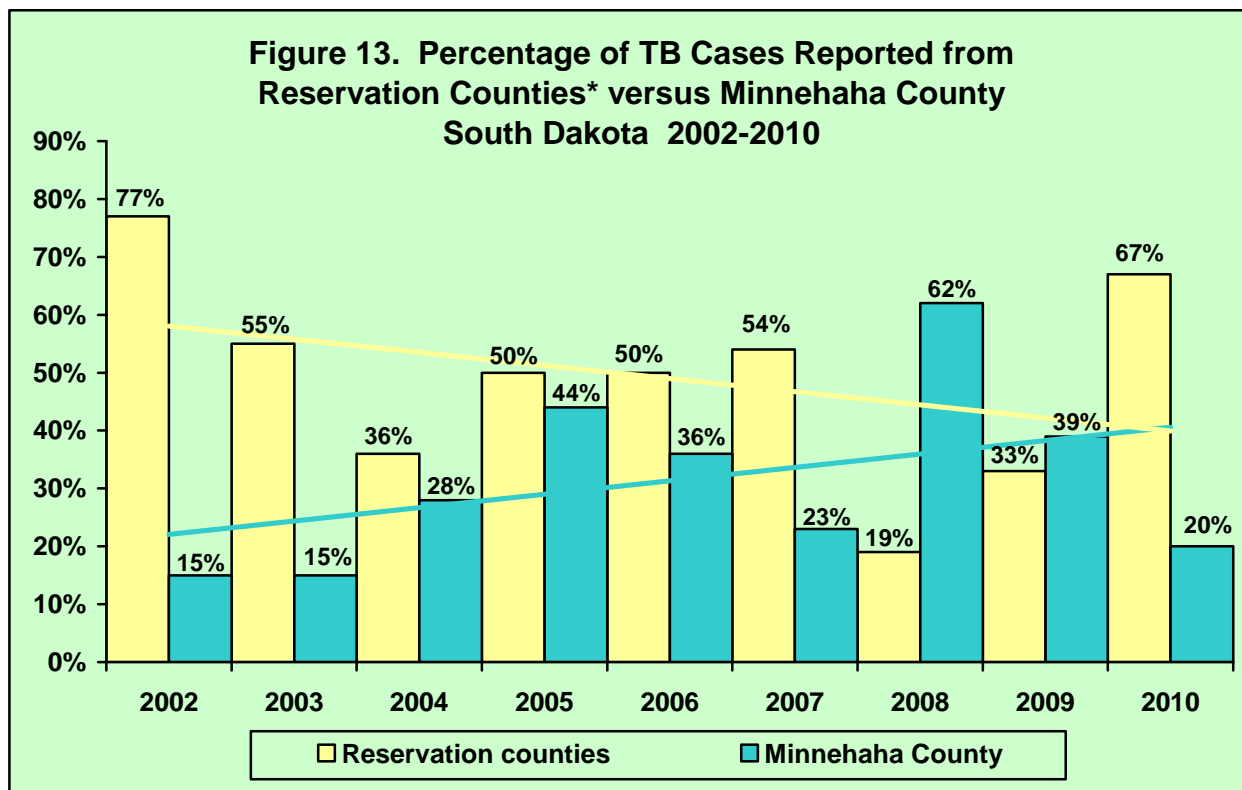
Most foreign-born persons who develop active TB usually do so within the first 2 years after arrival in the United States. Figure 11 describes that 59% of foreign-born TB cases since 1995 developed active TB within the first 2 years of their arrival. Because of this increased risk, these individuals are targeted for preventive TB program activities including targeted TB skin testing and preventive treatment programs.



Foreign-born TB cases continue to come from many areas of the world however the majority of the TB cases reported in South Dakota are of African descent. Figure 12 describes the country of birth for the foreign-born TB cases reported in South Dakota since 1995. Countries of birth for the “other” category include Afghanistan, China, El Salvador, Indonesia, Romania, Russia, South Africa and Vietnam.

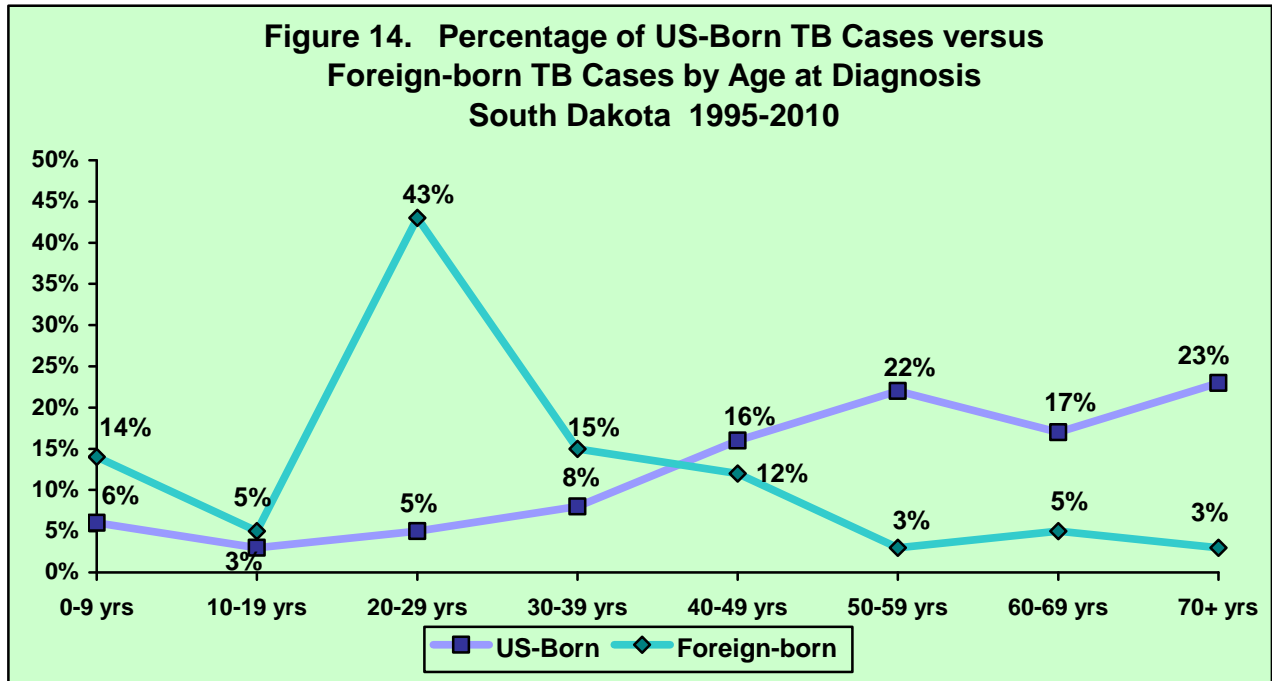


Another factor in the increase of foreign-born TB cases in South Dakota is the change in geography where TB cases are reported. Historically, the highest percentage of TB cases were reported from counties that included and bordered American Indian Reservations. As Native American TB cases decreased and foreign-born TB cases increased, there has been a geographic shift of TB cases from reservation counties to Minnehaha County as illustrated in Figure 13. This is due to the fact that most foreign-born persons who resettle in South Dakota do so in Minnehaha County.

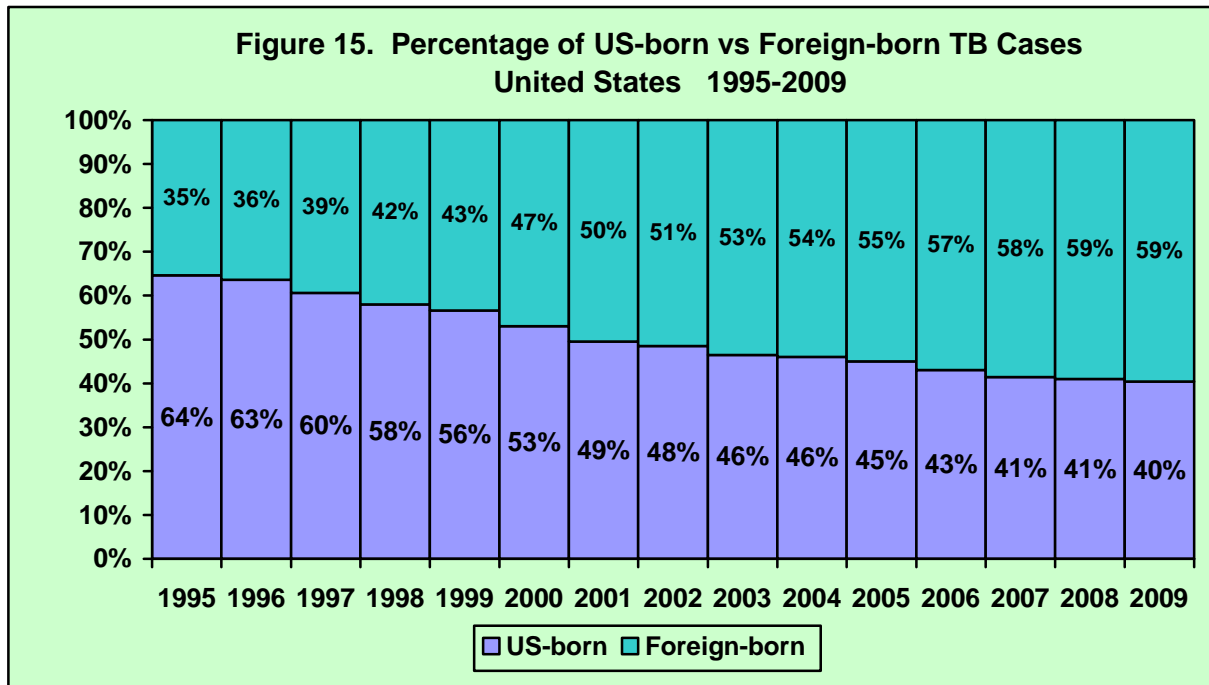


* Reservation counties include Bennett, Brule, Buffalo, Charles Mix, Corson, Dewey, Jackson, Mellette, Moody, Pennington, Roberts, Shannon, Todd, Tripp, Walworth and Ziebach counties.

Foreign-born TB cases are consistently reported in younger persons as compared to US born patients in South Dakota. This presents additional TB program management issues as these TB cases more commonly have young children who have been exposed at home and the TB cases are usually employed which requires an investigation at their worksite and therefore increases the number of contacts that must be screened and treated. Figure 14 illustrates that the majority of foreign-born TB cases are diagnosed while young adults.



Foreign-born TB cases represent a unique challenge to the South Dakota TB Control Program because of cultural issues, language barriers and a greater likelihood of drug resistance. As these cases continue to increase in South Dakota, additional time and resources will need to be dedicated to address these unique issues. Figure 15 describes the ever increasing trend of the percentage of foreign-born TB in the United States since 1995.



LATENT TB INFECTION AND PREVENTION ACTIVITIES

Ensuring for appropriate treatment and follow-up of active TB cases and suspects is the highest priority of the Tuberculosis Control Program. However, in order to achieve TB elimination in South Dakota, an emphasis must be made on preventing future cases of TB. This is accomplished by follow-up of persons infected with latent TB infection. These individuals are infected with the TB bacteria (*Mycobacterium tuberculosis*) but have not yet developed an active form of the disease. By finding and treating these individuals, future TB cases can be prevented and therefore the TB Control Program dedicates time and resources to this preventive strategy.

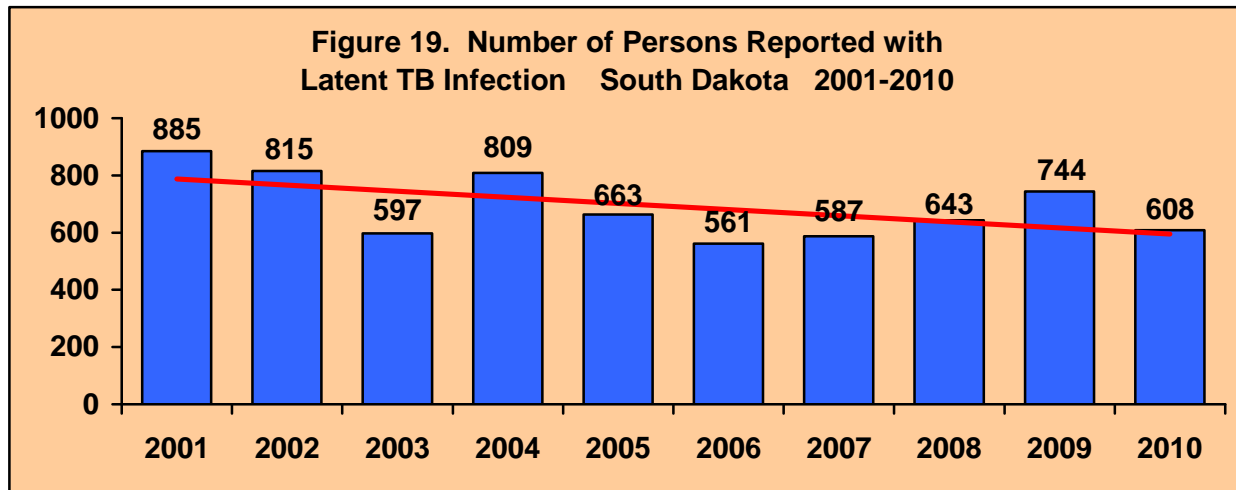


Figure 19 presents the number of patients reported with latent TB infection (positive TB skin tests or positive IGRA testing) over the last 10 years. All of these individuals have the potential to develop active TB disease and potentially be infectious to others.

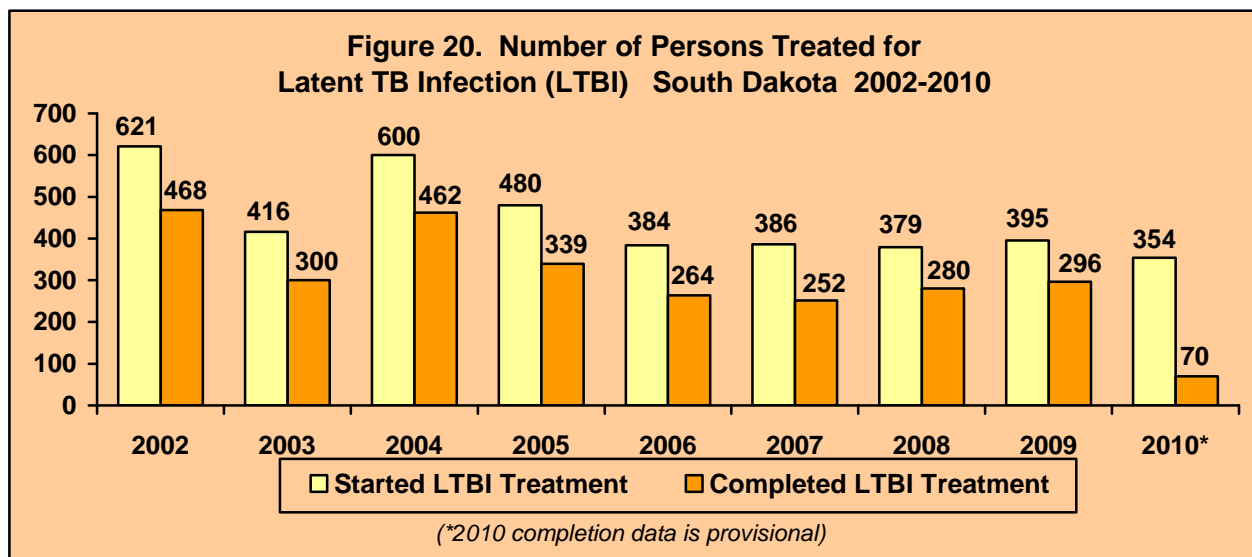
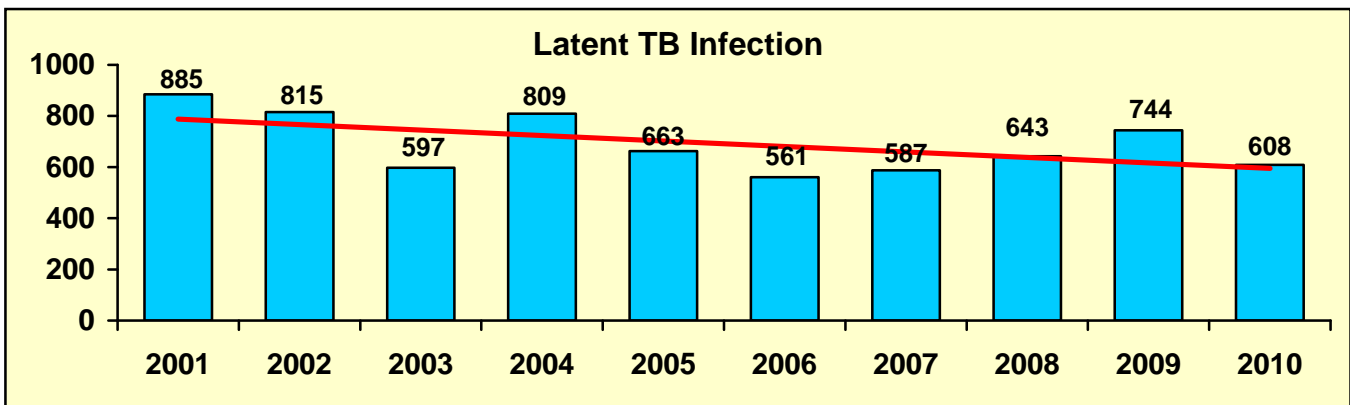
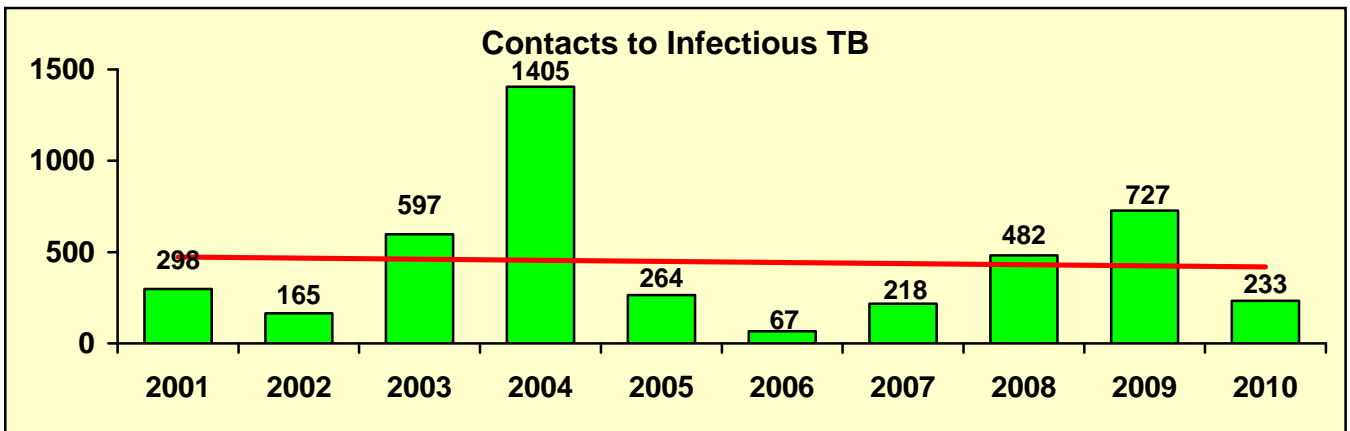
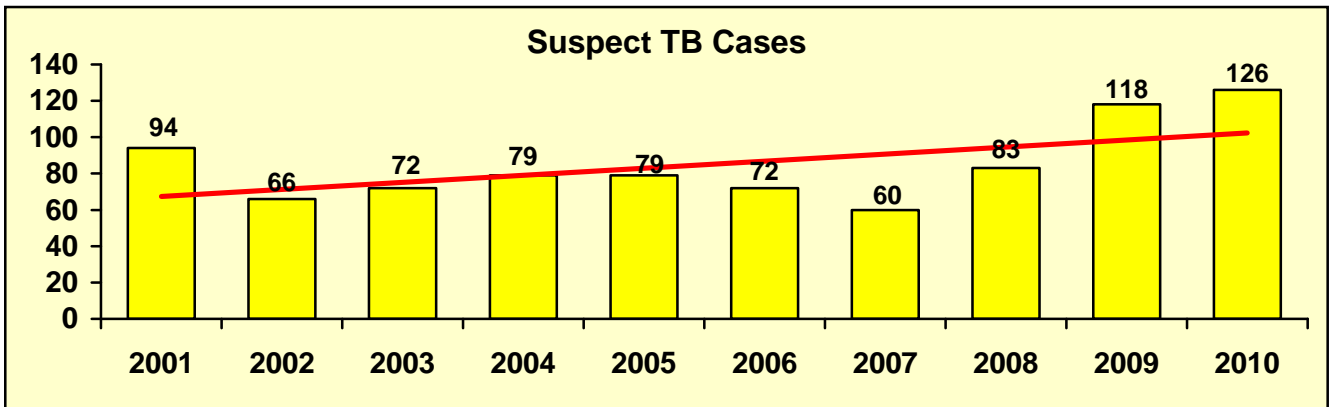
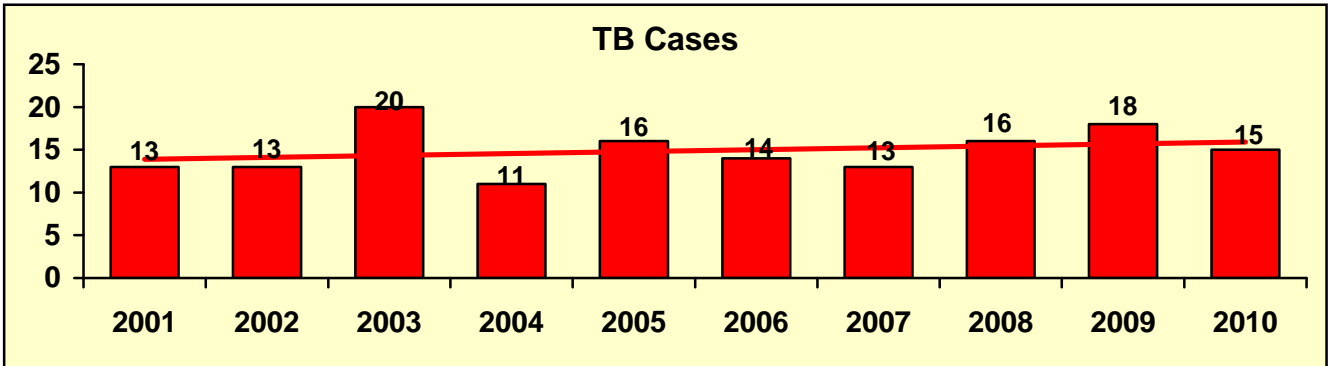


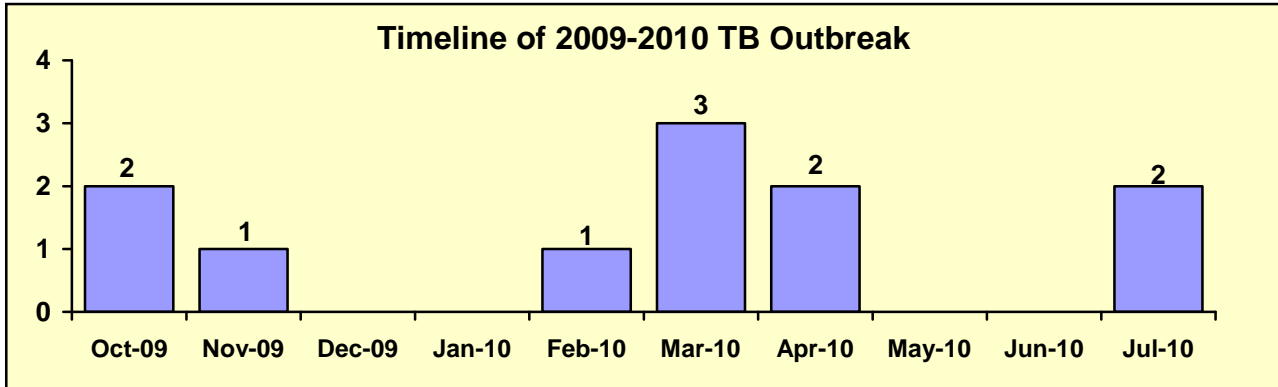
Figure 20 presents the number of patients with latent TB infection that started a course of preventive treatment as well as the number who completed this treatment. The treatment is usually done with Isoniazid (INH) which is provided free of charge to patients statewide by the TB Control Program.

Summary of TB Control Program Caseload South Dakota 2001-2010

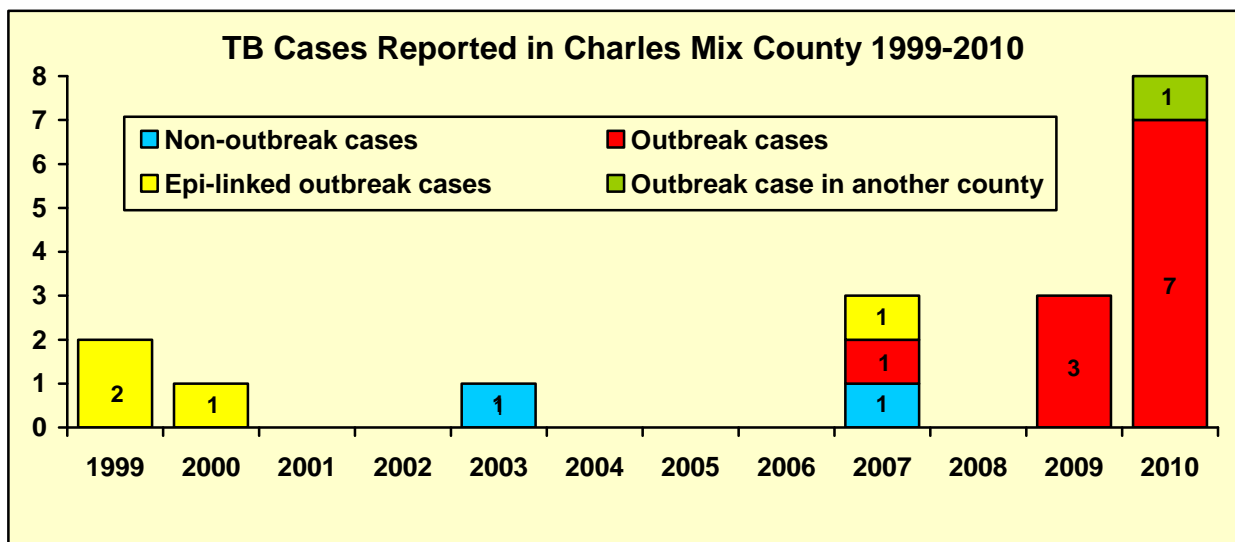


2009-2010 Tuberculosis Outbreak

During 2009 and 2010, there was a cluster of 11 TB cases reported over a 10 month time period, all of which were epidemiologically linked. These 11 outbreak cases accounted for 17% of the total cases reported statewide during 2009 and 69% of the total cases reported in 2010. All but one of these cases were reported in Charles Mix County. The first TB case reported in October 2009 was a 49 year old who had died 2 months prior. The second TB case was reported later that month with no known connection to the first case. The third TB case was diagnosed in November 2009 and was a sibling to the first case and exposed to the second TB case. The investigation focused on the extended family group from these 3 cases which included a large number of people living in approximately 10 different homes within 2 counties. Subsequently 8 additional TB cases were identified in this cluster. The graph below provides a timeline of the outbreak.



The first TB case was a non-pulmonary TB case and therefore was not originally suspected to be infectious; however, it was later determined this patient also had pulmonary TB and was likely infectious to others. Epidemiological information obtained during the investigation indicated that the second TB case was infectious for an extended period of time estimated to be back to January 2008. This resulted in a retrospective contact investigation being extended to January 2008. It was determined that the second TB case was highly infectious and was the likely source of exposure for many of the contacts and subsequent TB cases in this cluster. It was observed that TB cases from Charles Mix County in 1999, 2000 and 2007 were epidemiologically linked to cases in this outbreak and one TB case from 2007 was a genetic match to the outbreak as presented in the graph below.



The TB cases in this cluster consisted of 7 males and 4 females. Of the 11 cases reported, 8 were laboratory confirmed by culture. All 8 cases received drug susceptibility testing with no drug resistance observed. The remaining 3 cases were diagnosed through clinical or radiographic findings suggestive of active TB. Genotype testing was completed for the 8 laboratory confirmed cases which confirmed a genetic match between them, confirming the epidemiological links identified previously. The remaining 3 clinically diagnosed TB cases had strong epidemiological links to the other TB cases in this cluster. The genetic profile of the outbreak strain has not been observed anywhere else in South Dakota and was unique in the nation. Listed below is a summary of the investigation:

Summary of Persons Linked to the Outbreak	
11	TB cases diagnosed (1 died before diagnosis)
101	Contacts evaluated – not infected
1	Contact not evaluated (refused)
33	Contacts with new latent TB infection
2	Contacts with previous latent TB infection
2	Contacts with previous active TB
146	Total persons linked to the outbreak
Summary of Persons Treated	
10	TB cases treated (100% completed)
29	Contacts with new latent TB infection (97% completed – 1 moved)
2	Contacts with previous treatment for latent TB infection
2	Contacts with previous treatment for active TB
43	Total persons treated

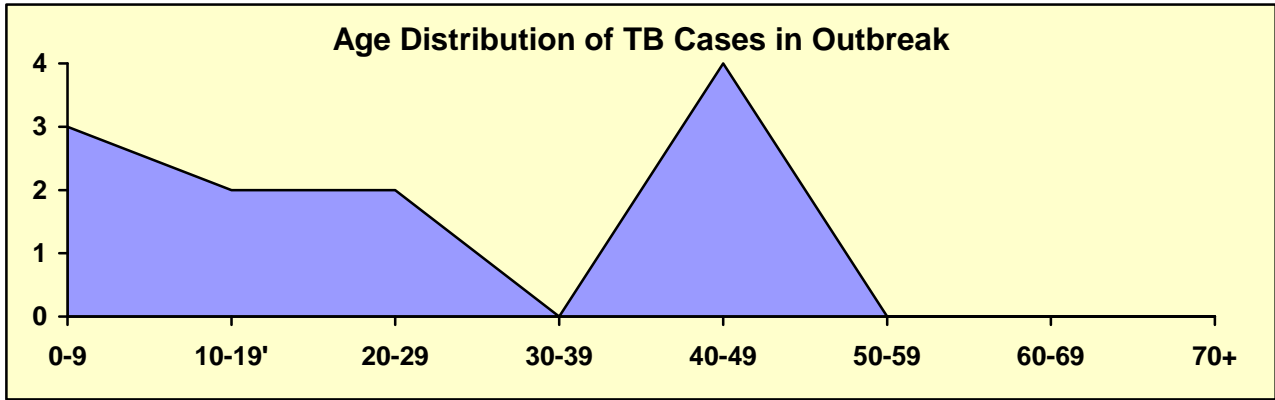
As part of the follow-up activities done during the contact investigation, students and staff at 3 schools were screened because of possible exposure to one or more of the identified TB cases. The screenings took place at a public high school, a tribal elementary school and a public elementary school in three different locations. The results of these screening are listed below.

	Public High School	Tribal Elementary School	Public Elementary School	TOTAL
Students	37	69	17	123
Staff	11	5	0	16
TOTAL	48	74	17	139
Positivity Rate	0%	0%	6%	<1%

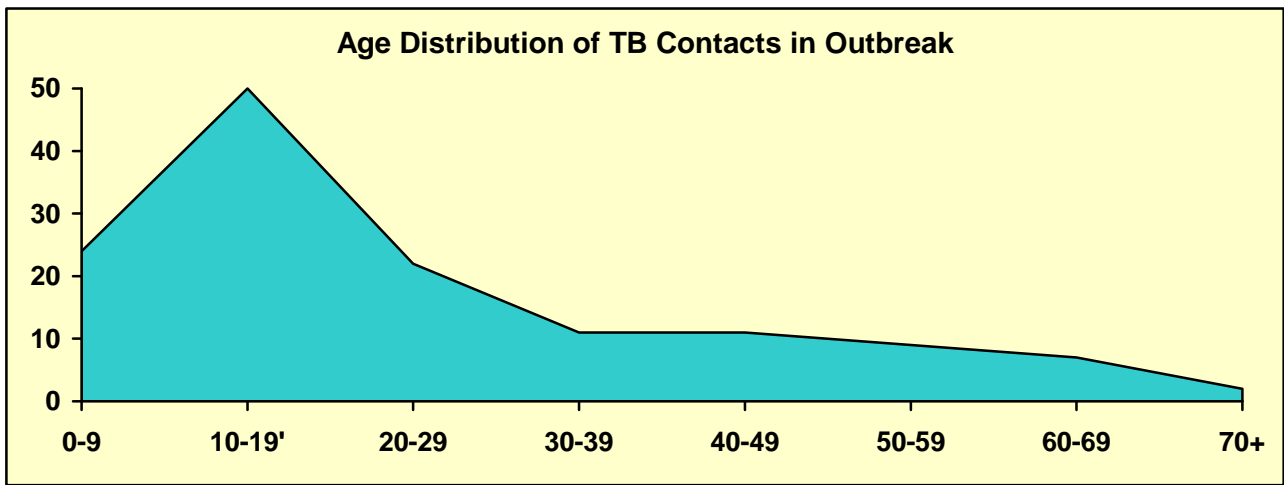
In addition, a community screening was also held as part of the follow-up activities done because of this outbreak. Listed below is a summary of this screening:

Summary of community screening	
87	Persons tested with negative results
1	Person tested but test not read
1	Person tested with a positive result
89	Total persons screened (1% positivity rate)

The TB cases in this cluster were younger than usual with the average age of the TB cases being 25 years of age. The age range of the cases was 7 months to 49 years of age. Of the 11 total cases, 5 cases were 15 years of age or younger. The age distribution of the TB cases in this outbreak is illustrated in the following graph:



The TB contacts identified in this outbreak were also younger than usual which presented several challenges for case management and treatment as well as a higher risk for development of active TB. The age distribution for the contacts is illustrated below:



Overall this TB outbreak presented the largest cluster of TB cases ever reported in South Dakota. There was considerable interest in the cluster nationally as CDC staff visited the state 3 times during the outbreak, including 2 different field investigation teams who conducted intense chart audits of every TB case and infected contact to ensure appropriate management of the outbreak. Listed below are the final TB program management rates for this investigation:

Positivity Rate =	<u># TB Cases + # new LTBI</u>	<u>40</u>		
	Total # contacts minus #previous LTBI patients	142	=	28%
Active TB Rate =	<u># TB cases</u>	<u>11</u>		
	Total # contacts identified	146	=	8%
Evaluation Rate =	<u># Contacts evaluated</u>	<u>145</u>		
	Total # contacts identified	146	=	99%
LTBI Rx Rate =	<u># LTBI patients started on treatment</u>	<u>29</u>		
	Total # untreated LTBI patients	29	=	100%