



County of San Diego
Health and Human Services Agency
Public Health Services

Tuberculosis Control Program 2013 Annual Report

October 2014

Nick Macchione, FACHE

Agency Director

Wilma J. Wooten, MD, MPH

Public Health Officer

Kathleen S. Moser, MD, MPH

Director, Tuberculosis and Refugee Health Branch

Table of Contents

Executive Summary	3
Technical Notes	4
Table 1 – Tuberculosis Cases, Case Rates per 100,000, and Percent Change: San Diego County, 1985-2013.....	5
Table 2 – Tuberculosis Cases, Percentages, and Case Rates per 100,000 Population by Age Group, San Diego County, 2000-2013.....	7
Table 3 – Tuberculosis Cases, Percentages, and Case Rates per 100,000 Population by Race/Ethnicity, San Diego County, 2000-2013.....	8
Table 4 – Tuberculosis Cases and Percentages by Top 12 Birth Countries, San Diego County, 2009-2013.....	9
Table 5 – Tuberculosis Cases and Percentages by Case Verification Criterion by Site of Disease, San Diego County, 2000-2013.....	10
Table 6A – Tuberculosis Cases and Percentages by Resistance to Isoniazid or Multidrug Resistance in Persons with No Previous History of TB, by U.S.- or Foreign-born Status, San Diego County, 2009-2013.....	11
Table 6B – Tuberculosis Cases and Percentages by Resistance to Isoniazid or Multidrug Resistance in Persons with a Previous History of TB, by U.S.- or Foreign-born Status, San Diego County, 2009-2013.....	11
Table 7 – Demographic and Clinical Characteristics of TB Cases with HIV Coinfection, San Diego County, 2010-2013	12
Table 8 – Tuberculosis Cases and Percentages by Completion of Tuberculosis Therapy (COT), San Diego County, 2008-2012.....	13
Table 9A – Tuberculosis Cases and Percentages by Social/Behavioral TB Risk Factor, San Diego County, 2010-2013	14
Table 9B – Tuberculosis Cases and Percentages by Medical TB Risk Factor, San Diego County, 2010-2013.....	14
Table 10 – Demographic and Clinical Characteristics of TB Cases due to <i>Mycobacterium bovis</i> , San Diego County, 2010-2013.....	15
Table 11 – Deaths Among Tuberculosis Cases, San Diego County, 2000-2013	16
References.....	17
Contact Information: San Diego County TB Control Program	17

Executive Summary

This report highlights data for tuberculosis (TB) cases reported in San Diego County in 2013, and includes recent and key historical data, to assist in interpretation. The data are based on the national case report (Report of a Verified Case of Tuberculosis [RVCT]), a standardized form used throughout the U.S., to collect data for the national TB surveillance system (1). In 2010, the revised RVCT was implemented, which includes information on medical risk factors and revised definitions of social risk factors. For the purposes of public health surveillance, a case of TB is defined on the basis of laboratory and/or clinical evidence of active disease due to *M. tuberculosis* complex (1).

Important trends in TB epidemiology in the county are highlighted.

- The annual number of TB cases and TB case rate decreased during 1993-2013, from 469 cases with a case rate of 18.1 per 100,000 to 206 total cases and a case rate of 6.5 cases per 100,000 in 2013. In 2011, the total count increased from 222 in 2010 to 263 cases with a case rate of 8.4 per 100,000. Review of the increase by demographic characteristics did not suggest a population of concern for recent transmission or importation.
- During 2009-2013, Hispanics accounted for more than 50% of cases, and Asians/Pacific Islanders accounted for approximately 33%. Among Hispanics, 38% were U.S.-born and 57% were born in Mexico. More than 95% of Asians/Pacific Islanders were born outside the U.S.
- During 2009-2013, persons born in Mexico, the Philippines, and Vietnam accounted for more than 50% of all TB cases.
- During 2009-2013, among persons with no history of prior TB, resistance to isoniazid (INH) was 9.7% and there were 8 multidrug-resistant (MDR) TB cases. Among those with past treatment, 22.9% were INH resistant and 4 had MDR disease. There were no extensively drug-resistant (XDR) TB cases during this period.
- During 2010-2013, a total of 66 (7%) of 925 TB patients in San Diego were also coinfecting with HIV.
- During 2010-2013, the most common medical risk factor for TB was diabetes, with 204 (22%) of 925 persons diagnosed with TB reporting a prior or concurrent diagnosis of diabetes.
- Overall, during 2008-2012, excluding deaths and moves out of the U.S., 97% of patients completed therapy. The proportion completing therapy within 1 year increased from 83% in 2008 at least 85% in 2009-2012.
- During 2008-2012, 1% of patients were dead at the time of TB diagnosis and 6% of patients died during TB treatment.
- During 2010-2013 in San Diego County, a total of 75 (10%) of 753 culture-positive TB cases had disease caused by *M. bovis*.

Live Well San Diego is a comprehensive wellness initiative developed by the County of San Diego. This long-term plan combines the efforts of county government, community partners and individuals to help all San Diego County residents be healthy, safe, and thriving. The initiative includes three components. *Building Better Health* was adopted by the San Diego County Board of Supervisors in 2010 and focuses on improving the health of residents and supporting healthy choices. *Living Safely*, adopted in 2012, focuses on protecting residents from crime and abuse, making neighborhoods safe, and supporting resilient communities. *Thriving*, pending adoption on October 21, 2014, will focus on cultivating opportunities for all people to grow, connect and enjoy the highest quality of life.

Technical Notes

Population data were obtained from the following sources:

- For 1985-1989, California Department of Finance County-level estimates, available at: <http://www.dof.ca.gov/HTML/DEMOGRAP/Data/DRUdatafiles.asp> (accessed July 2007).
- For 1990-1999, San Diego Association of Governments (SANDAG) Revised 1990s Demographic Estimates, issued July 2003.
- For 2000-2009, SANDAG Revised Estimates and 2010 Census, received by the San Diego County Health and Human Services Agency, Public Health Services, July 2012.
- For 2011-2013, SANDAG Revised Estimates, received by the San Diego County Health and Human Services Agency, Public Health Services, January 2014.

Drug resistance:

- Resistance to isoniazid (INH) was defined as resistance to at least INH, but isolate may be resistant to other antituberculous drugs.
- Multidrug-resistant TB was defined as resistance to at least INH and rifampin but isolate may be resistant to other antituberculous drugs.

Completion of therapy (Table 8):

- The calculations were based on the Centers for Disease Control and Prevention (CDC) algorithm (1). The cohort was defined as cases in persons alive at diagnosis who started treatment. Persons who died or moved out of the U.S. within 366 days of treatment initiation were excluded from the analysis.
- Cases without known initial rifampin resistance comprised the group of “Therapy \leq 1 Year Indicated.” In addition, cases with meningeal TB, TB of the central nervous system, or TB in the bone or skeletal system, and children less than 15 years old with disseminated disease were excluded from this cohort.
- Cases with meningeal TB, TB of the central nervous system, or TB in the bone or skeletal system, and children less than 15 years old with disseminated disease comprised the group of “Therapy $>$ 1 Year Indicated.”

Table 1 – Tuberculosis Cases, Case Rates per 100,000, and Percent Change: San Diego County, 1985-2013

Year	Cases	Rate	From Previous Year	
			Cases	Rate
1985	150	7.2	N/A	N/A
1986	148	6.9	-1.3	-4.5
1987	248	11.2	67.6	61.9
1988	195	8.5	-21.4	-24.0
1989	264	11.1	35.4	30.4
1990	329	13.2	24.6	19.2
1991	366	14.5	11.2	9.8
1992	433	16.8	18.3	16.3
1993	469	18.1	8.3	7.4
1994	420	16.1	-10.4	-10.8
1995	438	16.8	4.3	3.9
1996	384	14.7	-12.3	-12.6
1997	332	12.5	-13.5	-14.6
1998	342	12.7	3.0	1.1
1999	299	10.9	-12.6	-14.1
2000	295	10.5	-1.3	-3.5
2001	331	11.6	12.2	10.8
2002	326	11.3	-1.5	-2.9
2003	316	10.8	-3.1	-4.3
2004	320	10.8	1.3	0.4
2005	305	10.3	-4.7	-5.1
2006	315	10.6	3.3	2.9
2007	280	9.3	-11.1	-11.8
2008	264	8.7	-5.7	-6.8
2009	223	7.3	-15.5	-16.4
2010	222	7.2	-0.4	-1.4
2011	263	8.4	18.5	17.7
2012	234	7.5	-11.0	-11.4
2013	206	6.5	-12.0	-12.6

During 1985-1992, the United States experienced a resurgence in tuberculosis (TB) reflected by increasing annual TB case totals and case rates (1). This resurgence was attributed to multiple factors including decreased funding and weakened public health infrastructure, the HIV/AIDS epidemic, increasing immigration from higher prevalence countries, and transmission in congregate settings such as hospitals, homeless shelters, and correctional facilities. San Diego County also experienced an increase during this time period, although the magnitude of the increase may have been due in part to underreporting of TB to the health department prior to 1989.

Increased active surveillance activities with community providers were initiated by the health department's TB Control Program in the early 1990s. The County annual case total and case rate peaked in 1993 at 469 cases (18.1 cases per 100,000). During 1993-1999, the case count decreased by 36% (from 469 to 299 cases) and the case rate, by 43% (from 18.1 to 10.4 per 100,000), reflecting strengthened TB control strategies. The County case count and case rate rose briefly to 331 cases in 2001, but then gradually decreased to 222 total

cases and 6.9 cases per 100,000 in 2010. Economic and immigration trends as well as enhanced U.S.-required screening prior to immigration among persons establishing permanent residency in the U.S., may have contributed to these local decreases, as also observed nationally (2, 3).

In 2011, the total count increased by 41 cases to 263 cases with a case rate of 8.1 per 100,000. Increases were seen both among U.S.-born and foreign-born persons. The majority of the increase was among persons at least 65 years old, with 43 cases in 2010 and 70 in 2011, however, the increase was seen across all races/ethnicities. Cases in children remained low, continuing a 4-year trend. The number of cases with HIV co-infection remained stable. No specific or linking factors for the 2011 increase were identified nor was there a continued upward trend in subsequent years. The County case count (206) and case rate (6.5 cases per 100,000) in 2013 were the lowest in more than 2 decades.

Table 2 – Tuberculosis Cases, Percentages, and Case Rates per 100,000 Population by Age Group, San Diego County, 2000-2013

Year	Total Cases	0 - 4			5 -14			15 - 24			25 - 44			45 - 64			65+		
		No.	(%)	Rate	No.	(%)	Rate	No.	(%)	Rate	No.	(%)	Rate	No.	(%)	Rate	No.	(%)	Rate
2000	295	13	(4)	6.5	14	(5)	3.4	36	(12)	8.4	107	(36)	11.9	69	(23)	12.4	56	(19)	17.8
2001	331	18	(5)	9.4	16	(5)	3.7	45	(14)	10.4	102	(31)	11.3	89	(27)	15.3	61	(18)	18.7
2002	326	10	(3)	5.1	4	(1)	0.9	39	(12)	8.8	130	(40)	14.6	81	(25)	13.4	62	(19)	18.5
2003	316	15	(5)	7.5	11	(3)	2.6	45	(14)	10.0	105	(33)	11.8	97	(31)	15.5	43	(14)	12.5
2004	320	15	(5)	7.4	21	(7)	5.1	44	(14)	9.6	109	(34)	12.4	81	(25)	12.5	50	(16)	14.3
2005	305	14	(5)	6.8	15	(5)	3.7	43	(14)	9.3	89	(29)	10.3	80	(26)	12.0	64	(21)	17.9
2006	315	19	(6)	8.9	13	(4)	3.3	43	(14)	9.0	90	(29)	10.5	82	(26)	12.0	68	(22)	19.3
2007	280	10	(4)	4.7	5	(2)	1.3	51	(18)	10.4	81	(29)	9.4	82	(29)	11.6	51	(18)	14.8
2008	264	5	(2)	2.4	12	(5)	3.1	40	(15)	8.1	79	(30)	9.0	82	(31)	11.3	46	(17)	13.4
2009	223	9	(4)	4.4	9	(4)	2.3	21	(9)	4.3	77	(35)	8.7	55	(25)	7.3	52	(23)	15.0
2010	222	8	(4)	3.9	4	(2)	1.0	25	(11)	5.0	78	(35)	8.7	64	(29)	8.4	43	(19)	12.2
2011	263	7	(3)	3.5	7	(3)	1.8	30	(11)	6.0	68	(26)	7.6	81	(31)	10.5	70	(27)	19.3
2012	234	6	(3)	3.0	5	(2)	1.3	42	(18)	8.4	68	(29)	7.7	65	(28)	8.4	48	(21)	12.9
2013	206	3	(1)	NA	5	(2)	1.3	29	(14)	5.7	62	(30)	7.0	57	(28)	7.4	50	(24)	13.0

As the total number of TB cases in San Diego County declined over the past decade, all broad age groups experienced overall decreases. The most substantial declines occurred in children and adults aged 25-44. Among children less than 15 years old, the annual average of cases declined from 27 during 2002-2006 to 14, 2007-2013. Among adults aged 25 to 44 years old, the annual average of cases decreased from 105 during 2002-2006 to 73, 2007-2013. Adults 65 years and older remained the group with the highest risk, reflected by a case rate of 13.0 cases per 100,000 in 2013.

In 2013, children aged 0 to 4 years old accounted for 1% of cases. Although TB disease in young children reflects recent infection, a high proportion of pediatric TB in San Diego County is attributed to *Mycobacterium bovis* ([Table 10](#) – Demographic and Clinical Characteristics of TB Cases due to *Mycobacterium bovis*, San Diego County, 2010-2013). The disproportionate burden of TB due to *M. bovis* among children in the County suggests that consumption of unpasteurized dairy products is an important mode of transmission rather than person-to-person transmission via inhalation of aerosolized organisms (the method through which *M. tuberculosis* is spread).

Table 3 – Tuberculosis Cases, Percentages, and Case Rates per 100,000 Population by Race/Ethnicity, San Diego County, 2000-2013

Year	Total Cases	American Indian			Asian/Pacific Islander			Black			Hispanic			White		
		No.	(%)	Rate	No.	(%)	Rate	No.	(%)	Rate	No.	(%)	Rate	No.	(%)	Rate
2000	295	0	(0)	N/A	102	(35)	39.6	23	(8)	14.9	142	(48)	18.9	28	(9)	1.8
2001	331	1	(0)	N/A	97	(29)	36.5	20	(6)	12.8	164	(50)	21.3	49	(15)	3.2
2002	326	0	(0)	N/A	105	(32)	38.2	27	(8)	16.8	156	(48)	19.6	38	(12)	2.4
2003	316	0	(0)	N/A	92	(29)	32.6	24	(8)	15.1	159	(50)	19.5	41	(13)	2.6
2004	320	1	(0)	N/A	100	(31)	34.7	17	(5)	10.8	177	(55)	21.2	25	(8)	1.6
2005	305	0	(0)	N/A	95	(31)	31.8	19	(6)	12.3	160	(52)	18.7	31	(10)	2.0
2006	315	2	(1)	N/A	98	(31)	32.1	22	(7)	14.8	168	(53)	19.2	25	(8)	1.6
2007	280	0	(0)	N/A	100	(36)	32.2	22	(8)	15.2	144	(51)	16.0	14	(5)	0.9
2008	264	2	(1)	N/A	82	(31)	25.5	16	(6)	10.9	138	(52)	14.8	26	(10)	1.7
2009	223	0	(0)	N/A	75	(34)	22.5	22	(10)	14.9	106	(48)	11.0	20	(9)	1.3
2010	222	0	(0)	N/A	73	(33)	21.4	13	(6)	8.9	116	(52)	11.7	20	(9)	1.3
2011	263	1	(0)	N/A	97	(37)	27.8	13	(5)	9.1	127	(48)	12.6	25	(10)	1.7
2012	234	0	(0)	N/A	78	(33)	22.1	12	(5)	8.8	128	(55)	12.4	16	(7)	1.1
2013	206	0	(0)	N/A	64	(31)	17.8	11	(5)	8.3	115	(56)	10.9	16	(8)	1.1

Over the past decade, approximately 50% of San Diego County TB cases occurred in Hispanics, and the majority were born in the U.S. or Mexico. During 2009-2013, 38% of Hispanics were U.S.-born and 57% were born in Mexico. Case rates among Hispanics in San Diego County are substantially higher than national and California statewide rates, 5.0 and 5.3 per 100,000, respectively in 2013 (1,4). This likely reflects the effect of San Diego’s location along the U.S.-Mexico border. More than 95% of Asians and Pacific Islanders were born outside the U.S. Asians and Pacific Islanders accounted for approximately one-third of cases but had the highest risk, with case rates substantially higher than Hispanics and non-Hispanic whites and blacks. In 2013, blacks accounted for only 5% of cases, but the case rate (8.3 per 100,000) was more than seven times that in whites (1.1 per 100,000). During 2009-2013, nearly 60% of cases among blacks were born outside the U.S., primarily in Africa. Case rates among all race/ethnicity groups in San Diego County, however, have decreased over the past decade.

Table 4 – Tuberculosis Cases and Percentages by Top 10 Birth Countries, San Diego County, 2009-2013

Birth Country	2013		2012		2011		2010		2009	
	No.	(%)								
Total Cases	206	(100)	234	(100)	263	(100)	222	(100)	223	(100)
Mexico	63	(31)	73	(31)	75	(29)	64	(29)	63	(28)
Philippines	26	(13)	53	(23)	58	(22)	41	(18)	41	(18)
Vietnam	18	(9)	8	(3)	19	(7)	13	(6)	13	(6)
India	3	(2)	5	(2)	3	(1)	3	(1)	4	(2)
Somalia	2	(1)	5	(2)	3	(1)	3	(1)	3	(1)
China	4	(2)	4	(2)	1	(0)	3	(1)	3	(1)
Guatemala	4	(2)	1	(0)	0	(0)	3	(1)	4	(2)
Cambodia	1	(0)	1	(0)	1	(0)	4	(2)	3	(1)
Ethiopia	3	(1)	3	(1)	2	(0)	1	(0)	1	(0)
United States	64	(31)	67	(29)	78	(30)	62	(28)	74	(33)

A notable trend in the epidemiology of TB in the U.S. has been the increase in the proportion of cases occurring in persons born outside of the U.S. Between 1995 and 2013, the national percentage of TB cases in the foreign born increased from 35% to 65% (1). However, in San Diego County, the foreign-born accounted for 65% or more of reported cases during that period. Table 4 displays the top 10 countries of birth during 2009-2013. Persons born in the U.S. accounted for 30% of the cases during this period. Three other countries, Mexico, the Philippines, and Vietnam, accounted for more than 50%.

Individuals who are granted permanent U.S. resident status and officially designated refugees are screened for TB prior to U.S. entry. Approximately 3% are recommended to have rescreening upon U.S. entry (Class TB B1) (5). During 2010-2013, a total of 1,737 Class TB B1s were evaluated in San Diego County, and 31 (1.8%) were diagnosed with active TB. In this time period, among persons diagnosed with TB within their first year in the U.S., 3 (33%) of 9 cases born in Mexico, 22 (92%) of 24 cases born in the Philippines, and 3 (50%) of 6 persons born in Vietnam, had a TB B1 classification, which demonstrates the value of the federal overseas screening process.

During 2009-2013, less than 1% of foreign-born cases occurred in children less than 15 years old. In contrast, 17% of U.S.-born cases occurred in children. However, the annual average number of cases in U.S.-born children decreased from 23 during 2002-2006 to 13 during 2007-2011, to 9 cases, 2012-2013. Of the 42 cases in U.S.-born children 2010-2013, 35 (83%) had at least one parent or guardian born outside the U.S.

Table 5 – Tuberculosis Cases and Percentages by Case Verification Criterion by Site of Disease, San Diego County, 2000-2013

Year	Total Cases	Pulmonary				Extrapulmonary			
		Positive Culture No. (%)	Smear/NAAT + No. (%)	Clinical Case No. (%)	Provider Diagnosis No. (%)	Positive Culture No. (%)	Smear/NAAT + No. (%)	Clinical Case No. (%)	Provider Diagnosis No. (%)
2000	295	221 (93)	0 (0)	11 (5)	6 (3)	41 (72)	0 (0)	16 (28)	0 (0)
2001	331	232 (86)	0 (0)	26 (10)	11 (4)	43 (69)	0 (0)	15 (24)	4 (6)
2002	326	230 (91)	0 (0)	6 (2)	16 (6)	51 (69)	0 (0)	15 (20)	8 (11)
2003	316	213 (88)	1 (0)	9 (4)	18 (7)	46 (61)	1 (1)	20 (27)	8 (11)
2004	320	235 (90)	0 (0)	17 (6)	10 (4)	36 (62)	0 (0)	13 (22)	9 (16)
2005	305	204 (85)	0 (0)	17 (7)	18 (8)	45 (68)	0 (0)	16 (24)	5 (8)
2006	315	219 (88)	0 (0)	12 (5)	18 (7)	43 (65)	0 (0)	18 (27)	5 (8)
2007	280	213 (91)	0 (0)	8 (3)	12 (5)	34 (72)	1 (2)	8 (17)	4 (9)
2008	264	192 (91)	0 (0)	12 (6)	6 (3)	34 (63)	0 (0)	11 (20)	9 (17)
2009	223	151 (84)	0 (0)	12 (7)	16 (9)	25 (57)	0 (0)	12 (27)	7 (16)
2010	222	156 (85)	3 (2)	19 (10)	5 (3)	27 (69)	0 (0)	10 (26)	2 (5)
2011	263	194 (87)	1 (0)	23 (10)	4 (2)	22 (54)	0 (0)	15 (37)	4 (10)
2012	234	160 (84)	2 (1)	24 (13)	4 (2)	24 (55)	1 (2)	17 (39)	2 (5)
2013	206	158 (90)	3 (2)	11 (6)	4 (2)	12 (40)	5 (17)	13 (43)	0 (0)

*Smear/NAAT positive category includes cases since 2010, where a nucleic acid amplification test (i.e., NAAT) was done and positive, but the mycobacterial culture was negative or could not be completed, regardless of smear status. During 2010-2013, this category included 8 pulmonary cases and 5 extrapulmonary cases verified by positive NAAT.

TB cases are confirmed according to CDC guidelines (1). The majority of TB cases are confirmed via culture. In 2013, 90% of pulmonary cases (including those with extrapulmonary disease) were confirmed via culture compared with 40% of cases with only extrapulmonary disease. Since culture is the standard for diagnosis, few cases are confirmed exclusively by the identification of acid fast bacilli on sputum or other body fluid or tissue smear, in the absence of culture being performed (i.e., verification by positive smear). In 2010, the addition of a field to collect nucleic acid amplification test (NAAT) status in the national TB case report enabled cases that have a positive NAAT, but the mycobacterial culture was negative or not done, to be identified as meeting the laboratory case definition, regardless of smear status. In 2013, all cases in the smear/NAAT positive category were verified by a positive NAAT. In 2013, 43% of extrapulmonary cases were confirmed using the clinical case definition and none were categorized as Provider Diagnosis. This last category is comprised of clinical cases with negative tuberculin skin tests or interferon-gamma release assays (e.g., QuantiFERON®-Gold In Tube or T-SPOT®.TBtest), but a characteristic clinical course.

Table 6A – Tuberculosis Cases and Percentages by Resistance to Isoniazid or Multidrug Resistance in Persons with No Previous History of TB, by U.S.- or Foreign-born Status, San Diego County, 2009-2013

Year	Resistance to Isoniazid			Resistance to Isoniazid and Rifampin			
	Total Cases		U.S.-born	Total Cases		U.S.-born	Foreign-born
	No.	(%)	No. (%)	No.	(%)	No.	(%)
2009	15	(8.8)	1 (1.9)	14 (12.0)	2 (1.2)	1 (1.9)	1 (0.9)
2010	14	(7.9)	3 (6.5)	11 (8.4)	1 (0.6)	0 (0.0)	1 (0.8)
2011	27	(13.8)	7 (13.5)	20 (13.9)	3 (1.5)	1 (1.9)	2 (1.4)
2012	16	(9.1)	4 (7.5)	12 (9.8)	1 (0.6)	0 (0.0)	1 (0.8)
2013	13	(8.0)	4 (8.5)	9 (7.8)	1 (0.6)	0 (0.0)	1 (0.9)
2009-2013	85	(9.7)	19 (7.6)	66 (10.5)	8 (0.9)	2 (0.8)	6 (1.0)

Table 6B – Tuberculosis Cases and Percentages by Resistance to Isoniazid or Multidrug Resistance in Persons with a Previous History of TB, by U.S.- or Foreign-born Status, San Diego County, 2009-2013

Year	Resistance to Isoniazid			Resistance to Isoniazid and Rifampin			
	Total Cases		U.S.-born	Total Cases		U.S.-born	Foreign-born
	No.	(%)	No. (%)	No.	(%)	No.	(%)
2009	1	(16.7)	0 (0.0)	1 (33.0)	1 (16.7)	0 (0.0)	1 (33.3)
2010	1	(16.7)	0 (0.0)	1 (20.0)	0 (0.0)	0 (0.0)	0 (0.0)
2011	5	(25.0)	2 (40.0)	3 (20.0)	0 (0.0)	0 (0.0)	0 (0.0)
2012	2	(25.0)	0 (0.0)	2 (25.0)	1 (12.5)	0 (0.0)	1 (12.5)
2013	5	(25.0)	0 (0.0)	2 (28.6)	2 (25.0)	0 (0.0)	2 (28.6)
2009-2013	11	(22.9)	2 (20.0)	9 (23.7)	4 (8.3)	0 (0.0)	4 (10.5)

TB may become resistant to medications if treatment is inadequate because of a suboptimal treatment regimen or due to patient nonadherence. Resistant TB is more difficult and costly to treat, especially multidrug-resistant (MDR) TB, defined as resistance to at least isoniazid (INH) and rifampin, the two most effective first-line drugs. Studies have noted that MDR TB has a lower cure rate and a higher mortality rate, although this has not been the case in San Diego. Extensively drug-resistant TB (XDR TB) is a relatively rare type of MDR TB also resistant to two additional classes of medications: fluoroquinolones and at least one of three injectable drugs (amikacin, kanamycin, or capreomycin). Table 6A shows drug resistance for initial TB isolates among persons with no prior history of TB. These persons were presumably infected with the drug-resistant organism. During 2009-2013, overall resistance to INH was 9.7% and there were 8 MDR TB cases, representing 0.9% of culture-positive cases. For the 5-year period average, persons born outside the U.S. had higher rates of INH drug-resistant TB and MDR TB, compared with U.S.-born persons. Table 6B shows drug resistance among persons with a prior history of TB. Their drug resistant TB often reflects resistance acquired during treatment of their prior TB episode. During 2009-2013, resistance to INH among persons with prior TB was twice that among persons with no prior TB episode. MDR TB rates were nearly ten times higher among persons with prior TB compared with those with no prior episode. There were no prior TB cases with MDR TB identified among U.S.-born persons. Also, during this period, there were no XDR TB cases. Among all cases reported during 2009-2013, 1.3% (12 cases) were MDR; among these, 83% (10 cases) were foreign-born and 33% (4 cases) reported a previous TB episode.

Table 7 – Demographic and Clinical Characteristics of TB Cases with HIV Coinfection, San Diego County, 2010-2013 (N= 66)

Characteristic	No.	(%)
Agegroup		
15-24	4	(6)
25-44	35	(53)
45-64	24	(36)
65+	3	(5)
Race/ethnicity		
Black, non-Hispanic	5	(8)
Hispanic	48	(73)
White, non-Hispanic	11	(17)
Other	2	(3)
Birth Country		
Mexico	28	(42)
United States	30	(45)
Other [†]	8	(12)
TB Risk Factors		
Injecting Drug Use*	4	(6)
Non-injecting Drug Use*	17	(26)
Correctional Inmate**	12	(18)
Homeless*	10	(15)
At least one risk factor	30	(45)
Clinical Presentation		
Pulmonary TB	59	(89)
Sputum-smear positive	23	(40)
Extrapulmonary TB (only)	7	(11)
Culture-positive	56	(85)
<i>M. bovis</i>	13	(23)
Isoniazid Resistance	4	(7)
Multidrug-resistance	0	(0)

[†] 3 South/Central America, 3 Caribbean, 0 Africa, 2 Asia
 *In year prior to TB diagnosis; **At TB diagnosis

The percentage of TB patients in San Diego that had a known HIV test status at TB diagnosis increased from 81% during 2010-2011 to 91%, 2012-2013. During 2010-2013, a total of 66 (7%) of 925 TB patients in San Diego were coinfecting with HIV. Nearly 90% of coinfecting cases occurred in persons aged 25-64 years old, 73% were Hispanic, and 42% were born in Mexico. Most (89%) were diagnosed with pulmonary TB, with or without extrapulmonary involvement, and 40% of these patients had an elevated infectious potential based on a positive sputum smear for acid fast bacilli. Drug resistance was not notably higher than among all TB patients; however, 23% of culture-positive patients had TB due to *M. bovis*. Disease due to *M. bovis* is most commonly attributed to consumption of unpasteurized dairy products (see [Table 2](#) – Tuberculosis Cases, Percentages, and Case Rates per 100,000 Population by Age Group, San Diego County, 2000-2013 and [Table 10](#) – Demographic and Clinical Characteristics of TB Cases due to *Mycobacterium bovis*, San Diego County, 2010-2013), although person-to-person transmission via inhalation of aerosolized organisms may occur as well. A detailed analysis of TB patients in San Diego coinfecting with HIV has been published (6).

Table 8 – Tuberculosis Cases and Percentages by Completion of Tuberculosis Therapy (COT), San Diego County, 2008-2012

Year	Therapy \leq 1 Year Indicated*			Therapy $>$ 1 Year Indicated**		All Cases	
	No.	COT \leq 1 year(%)	COT(%)	No.	COT (%)	No.	COT(%)
2008	221	(83)	(97)	10	(100)	231	(97)
2009	186	(87)	(95)	14	(93)	200	(95)
2010	178	(89)	(97)	18	(100)	196	(97)
2011	213	(85)	(98)	28	(96)	241	(98)
2012	191	(88)	(99)	14	(93)	205	(99)

*Excludes cases with meningeal TB, TB of the central nervous system, or TB in bone or the skeletal system; children $<$ 15 years old TB with disseminated TB; and, cases with rifampin-resistant TB.

** Cases with meningeal TB, TB of the central nervous system, or TB in bone or the skeletal system; children $<$ 15 years old with disseminated TB; and, cases with rifampin-resistant TB.

A key objective of TB control programs is to ensure that patients complete appropriate therapy. This strategy limits relapse and assists in reducing transmission and risk for the development of drug resistance. The CDC has a performance measure of timely completion of therapy, for persons whose initial TB presentation indicated \leq 1 year of TB treatment was sufficient (1). The usual TB treatment duration is 6 months for drug-susceptible TB, but may be longer in the setting of extensive disease, poor clinical response, or development of drug side effects (7).

Each annual case cohort is followed for 2 years for ascertainment of treatment outcome data. Overall, during 2008-2012, 97% of patients completed therapy. Of those eligible, the percentage completing therapy in \leq 1 year increased from 83% in 2008 to at least 85% in 2009-2012. Annual reviews have confirmed that the majority of patients with delayed completion had clinically indicated reasons for extension of treatment, primarily medication intolerance or extensive disease/delayed treatment response.

Table 9A – Tuberculosis Cases and Percentages by Social/Behavioral TB Risk Factor, San Diego County, 2010-2013

TB Risk Factor	2010-2013		2010		2011		2012		2013	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Long-term Care Resident at Diagnosis	6	(1)	3	(1)	2	(1)	0	(0)	1	(0)
Correctional Inmate at Diagnosis	95	(10)	29	(13)	20	(8)	22	(9)	24	(12)
Homeless*	65	(7)	10	(5)	14	(5)	28	(12)	13	(6)
Health Care Worker**	32	(3)	9	(4)	9	(3)	9	(4)	5	(2)
Migrant Worker**	6	(1)	1	(0)	3	(1)	0	(0)	2	(1)
Injecting Drug Use*	20	(2)	1	(0)	4	(2)	8	(3)	7	(3)
Non-injecting Drug*	107	(12)	26	(12)	21	(8)	27	(12)	33	(16)
Excess Alcohol Use*	123	(13)	28	(13)	33	(13)	32	(14)	30	(15)
At Least One Drug Use Risk Factor	173	(19)	37	(17)	42	(16)	46	(20)	48	(23)
At Least One Risk Factor	267	(29)	62	(28)	68	(26)	70	(30)	67	(33)

*In year prior to diagnosis

**Primary occupation in year prior to TB diagnosis.

The national TB case report collects information about population risk factors for TB infection and disease. Among persons reported with TB during 2010-2013, the most commonly identified risks included excessive alcohol use (13%), non-injecting drug use (12%), diagnosis of TB as a correctional inmate (10%), and homelessness (7%). Nineteen percent had at least one drug use risk factor, and 29% of patients had at least one TB social/behavioral risk factor.

Table 9B – Tuberculosis Cases and Percentages by Medical TB Risk Factor, San Diego County, 2010-2013

Medical TB Risk Factor	2010-2013		2010		2011		2012		2013	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Diabetes	204	(22)	47	(21)	73	(28)	49	(21)	35	(17)
End Stage Renal Disease	21	(2)	1	(0)	5	(2)	7	(3)	8	(4)
Anti-Tumor Necrosis Factor (TNF) treatment	13	(1)	4	(2)	2	(1)	3	(1)	4	(2)
Solid organ transplantation	7	(1)	2	(1)	2	(1)	1	(0)	2	(1)
Immunosuppression other than HIV	57	(6)	17	(8)	23	(9)	12	(5)	5	(2)
HIV infection	66	(7)	15	(7)	18	(7)	18	(8)	15	(7)
At Least One Medical Risk Factor	318	(34)	74	(33)	105	(40)	79	(34)	60	(29)

Starting in 2010, several medical risk factors were added to the national case report. During 2010-2013, the most common medical risk factor was diabetes, with 204 (22%) of 925 persons diagnosed with TB reporting a prior or concurrent diagnosis of diabetes. A total of 258 (28%) reported at least one medical risk factor, including diabetes, end stage renal disease, organ transplantation, tumor necrosis factor antagonist therapy, or immunosuppression other than HIV. This number increased to 318 (34%) when persons with HIV coinfection as their only TB medical risk factor were included.

Table 10 – Demographic and Clinical Characteristics of TB Cases due to *Mycobacterium bovis*, San Diego County, 2010-2013 (N=75)

	No.	(%)
Agegroup		
0-4	2	(3)
5-14	2	(3)
15-24	8	(11)
25-44	24	(32)
45-64	23	(31)
65+	16	(21)
Race/ethnicity		
Asian/Pacific Islander	1	(1)
Black	0	(0)
Hispanic	73	(97)
White	1	(1)
Birth Country*		
US	21	(28)
Mexico	50	(67)
Clinical Presentation		
Pulmonary TB alone	21	(28)
Pulmonary + Extrapulmonary	22	(29)
Extrapulmonary TB (only)	32	(43)
Cervical Lymphadenopathy	13	(41)
Peritoneal	10	(31)
HIV coinfection	13	(17)
Isoniazid Resistance	1	(1)

*3 patients born in country of Asia or Central/South America

Disease due to *Mycobacterium bovis* is usually contracted through the consumption of unpasteurized dairy products. Person-to-person transmission via inhalation of aerosolized organisms (the method through which *M. tuberculosis* is spread) is also believed to occur. TB due to *M. bovis* is more frequently identified among San Diego County TB cases, using biochemical techniques, compared with the national average of approximately 1%, estimated using genotyping techniques (8). During 2010-2013 in San Diego County, a total of 75 (10%) of 753 culture-positive TB cases had disease caused by *M. bovis*. More than 60% occurred among the 25 to 64 year old age groups; and, 5% occurred among children less than 15 years old. Among persons with culture-proven TB, 10% of adults and 33% of children less than 15 years old had TB due to *M. bovis*. Nearly all cases due to *M. bovis* were Hispanic and 68% were born in Mexico.

Pulmonary TB was a less frequent presentation (57%) than among all culture-confirmed cases (89%). The most common extrapulmonary presentations were cervical lymphadenopathy and peritoneal TB. Resistance to isoniazid was lower than among all TB cases, and no multidrug-resistant (MDR) TB cases occurred. All *bovis* cases had isolates resistant to pyrazinamide, the natural resistance pattern associated with *M. bovis*. The standard treatment duration for patients with *bovis* disease is usually extended to 9 months, since pyrazinamide is a critical first-line drug in the “short course” TB treatment regimen (7). A detailed analysis of cases in San Diego County due to *M. bovis* compared with those due to *M. tuberculosis* has been published (9).

Table 11 – Deaths Among Tuberculosis Cases, San Diego County, 2000-2013

Year	Total Cases	Dead at Diagnosis		Died During Therapy	
		No.	(%)	No.	(%)
2000	295	4	(1)	25	(8)
2001	331	4	(1)	23	(7)
2002	326	9	(3)	18	(6)
2003	316	7	(2)	20	(6)
2004	320	7	(2)	13	(4)
2005	305	4	(1)	13	(4)
2006	315	8	(3)	23	(7)
2007	280	5	(2)	11	(4)
2008	264	9	(3)	12	(5)
2009	223	3	(1)	13	(6)
2010	222	4	(2)	12	(5)
2011	263	4	(2)	17	(6)
2012	234	0	(0)	17	(7)
2013	206	1	(0)	16	(8)

Preliminary data for 2013 cases.

During 2000-2013, 2% of persons identified as TB cases were dead at the time of TB diagnosis. Among those alive at TB diagnosis, 6% died during therapy. The majority (58%) of deaths occurred among persons 65 years and older. There was 1 death in a child less than 15 years old. Initial review of cases during 2010-2013 indicate that TB contributed to death in approximately half of the cases. More detailed reviews are ongoing to better define the contribution of TB disease and/or therapy to deaths among persons with TB and identify potential opportunities for prevention.

References

1. Centers for Disease Control and Prevention. Reported tuberculosis in the United States, 2013. Atlanta, GA:U.S. Department of Health and Human Services, CDC, October 2014. Available at: <http://www.cdc.gov/TB/statistics/reports/2013>.
2. Centers for Disease Control and Prevention. Trends in tuberculosis, United States, 2010. *MMWR* 2011;60:333-337. Available at: <http://www.cdc.gov/mmwr/pdf/wk/mm6311.pdf>.
3. Centers for Disease Control and Prevention. Decrease in reported tuberculosis cases, United States, 2009. *MMWR* 2010;59:289-294. Available at: <http://www.cdc.gov/mmwr/pdf/wk/mm5910.pdf>.
4. California Department of Public Health. Report on Tuberculosis in California, 2013. Richmond, CA:California Health and Human Services Agency, August 2014. Available at: http://www.cdph.ca.gov/programs/tb/Documents/TBCB_Report_2013.pdf.
5. Centers for Disease Control and Prevention. Disease surveillance among newly arriving refugees and immigrants—Electronic Disease Notification System, United States, 2009. *MMWR* 2013;62(No. SS-7). Available at: <http://www.cdc.gov/mmwr/pdf/ss/ss6207.pdf>.
6. Rodwell TC, Barnes RFW, Moore M, Strathdee SA, Raich A, Moser KS, Garfein RS. HIV-tuberculosis coinfection in southern California: evaluating disparities in disease burden. *Am J Public Health* 2010 April; 100 Suppl 1: S178-S185.
7. Centers for Disease Control and Prevention. Treatment of tuberculosis, American Thoracic Society, CDC, and Infectious Diseases Society of America. *MMWR* 2003;52(No. RR-11). Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5211a1.htm>.
8. Hlavsa M, Moonan P, Cowan L, et al. Human tuberculosis due to *Mycobacterium bovis* in the United States, 1995-2005; *Clin Infect Dis* 2008; 47; 168-175.
9. Rodwell TC, Moore M, Moser KS, Brodine SK, Strathdee SA. *Mycobacterium bovis* tuberculosis in binational communities. *Emerg Infect Dis* [serial on the Internet] 2008 Jun. Available at <http://www.cdc.gov/eid/content/14/6/909.htm>.

Contact Information: San Diego County HHSA PHS TB Control Program

Telephone: (619) 692-5565

Internet: <http://www.sandiegotbcontrol.org>

Address: 3851 Rosecrans Street, Suite 128
San Diego, CA 92110