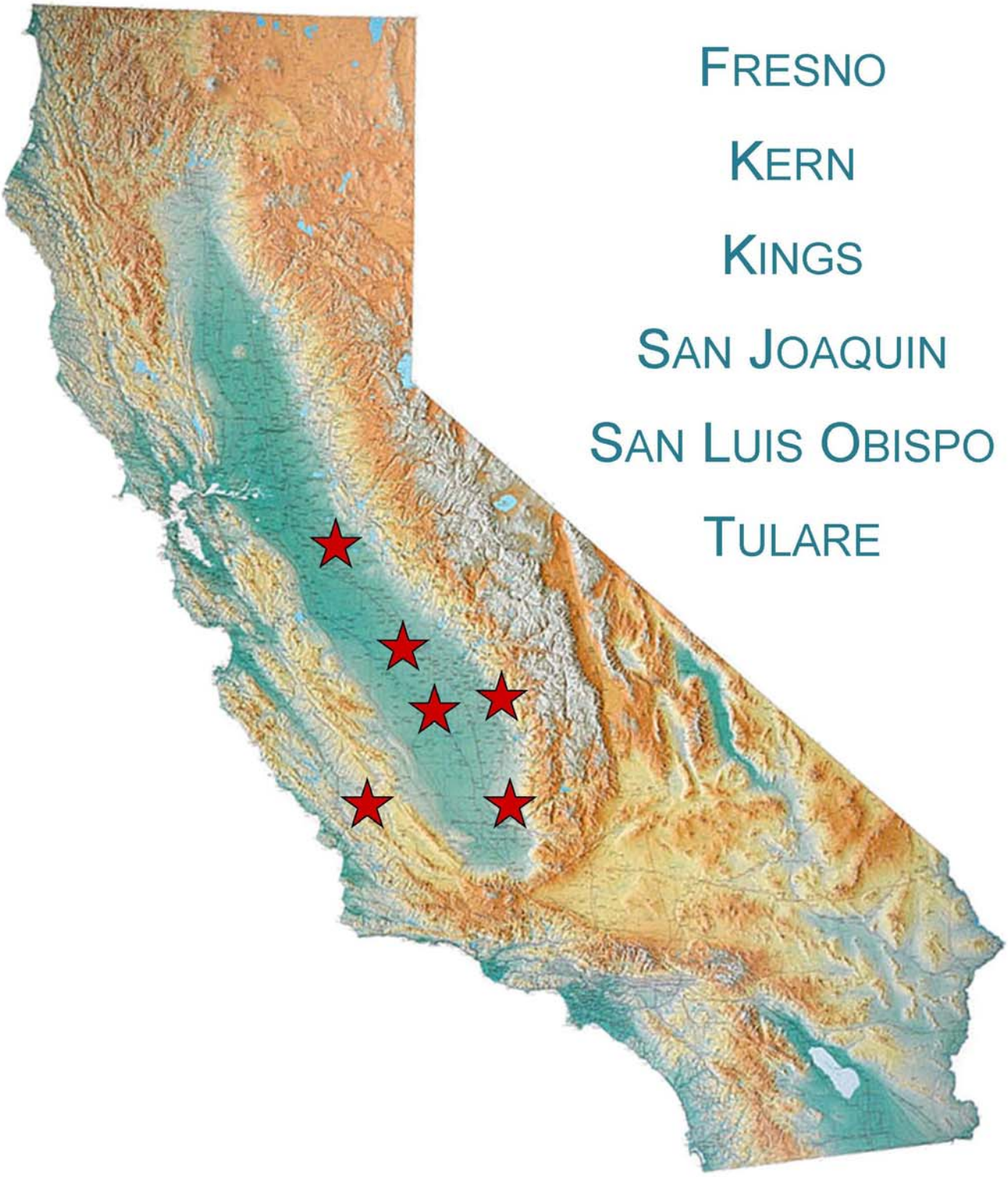
Epidemiology of Coccidioidomycosis in Six California Counties

2011



Fresno

Kern

Kings

San Joaquin

San Luis Obispo

Tulare

STUDY PARTICIPANTS

- Faisal Aranki, M.D., M.P.H., Epidemiologist
- Ken Bird, M.D., M.P.H., Deputy Health Officer
- Penny Borenstein, M.D., M.P.H., Health Officer
- Kirt Emery, M.P.H., Epidemiologist & Director of the Health Assessment and Epidemiology Program
- Karen Haught, M.D., M.P.H., Health Officer
- Nancy Hitchcock, R.N., P.H.N., Supervising Public Health Nurse
- Claudia Jonah, M.D., Health Officer
- David Luchini, R.N., P.H.N., Community Health Division Manager
- Michael Mac Lean, M.D., M.S., Health Officer
- Ann McDowell, M.P.H., Epidemiologist
- Karen Pfister, M.S., Supervising Epidemiologist

Contributors:

- Sharon Minnick, PhD, M.S., Epidemiologist

Coccidioidomycosis is recognized as a significant public health problem in a limited number of California counties. Approximately 80% of the cases reported in California in 2010 were from Fresno, Kern, Kings, San Joaquin, San Luis Obispo, and Tulare Counties. On May 13, 2011 these counties met in Hanford, California to share their coccidioidomycosis data. Other endemic counties were invited but were unable to attend. Personnel from the California Department of Public Health were invited but were unable to attend because of state travel restrictions. The population and demographics of the six counties are noted in the appendix.

Coccidioidomycosis has been a nationally reportable disease since 1996. The present case definition in California is consistent with Council of State and Territorial Epidemiologists criteria and includes both clinical and laboratory elements. Since 2010 California has required that any positive laboratory result be reported to the local health department. Approximately 60% of infections cause either no symptoms or a clinical illness so mild that affected individuals seek no medical attention. Ninety percent or more of coccidioidal disease is indistinguishable from clinical illness caused by many other etiologic agents. An influenza-like illness or a community acquired pneumonia are the most common clinical manifestations of coccidioidomycosis. The laboratory diagnosis most often is based on ordering coccidioidomycosis specific serology. Less commonly the laboratory diagnosis is dependent on fungal culture or clinical pathology specimens with special stains. The disease is more likely to be detected when both the "at risk" community and the provider community are educated about it. The disease is usually self-limited. The condition will resolve without specific treatment. Coccidioidomycosis is very likely under-diagnosed even in the recognized endemic areas of California. The under-reporting of diagnosed reportable diseases is well recognized in California. For all these reasons we feel that the cases noted in this report significantly under-estimate the cases in the six counties. Further, we speculate that the under-diagnosis of coccidioidomycosis is likely an even bigger problem in the less endemic California counties.

CASE COUNTS:

Each county was asked to choose the epidemiology data they wished to present and the format and content of the presentations was quite variable. The six counties presented data on 14,864 cases as shown in Table 1.

Table 1

CASES BY COUNTY

County	Years	Interval	Case Number
Tulare	10	2001-2010	1,589
San Luis Obispo	11	2000-2010	993
Kings	4	2007-2010	854
Fresno	7	2004-2010	3,160
San Joaquin	20	1991-2010	616
Kern	6	2005	7,652
		Total:	14,864

The reporting intervals ranged from four to twenty years. In some cases the case definition may have changed during the reporting interval. Of the six counties, Kern County was the only jurisdiction that reports cases based solely on the laboratory portion of the case definition. Like the state of Arizona, the volume of cases and resource limitations have necessitated this methodology. Often the counties did not report rates but instead reported frequencies. The date of the cases is quite variable even within a county's data. The date of a case may be by date of onset, date of diagnosis, date of confirming laboratory or date of report. The epidemiologists present at the meeting would prefer reporting by date of onset. Kings County reported on their experience with trying to estimate the date of onset. Despite review of medical records and patient interviews, a date of onset could be determined in only 75% of the cases. In those cases where a date of onset was determined, the observed interval between the date of onset and the date of diagnosis was greater than 35 days in one third (33%) of the cases. We do not feel that the date used to report the case represents a significant problem when comparing cases across jurisdictions by age, gender, race/ethnicity or residence. However, it is probably not advisable to compare cases by month or week across jurisdictions.

UNEVEN RISK WITHIN COUNTIES:

We acknowledge that the literature documents that analysis of cases by residence is not ideal. The literature well documents disease acquisition far from one's place of residence. With this caveat in mind, we note that the risk for coccidioidomycosis is not evenly distributed within each of the six counties. In Kern, Kings, Fresno and San Joaquin Counties the rates of disease is higher in the western parts of the counties. In San Luis Obispo the risk is higher in the northern half of the county. In Tulare County the rate is higher in the southern part of the county. The magnitude of the risk by area in the county is moderately variable.

In Tulare County, the ten year average annual rate in the southern city of Porterville was 84/100,000 compared with 24/100,000 in the northern city of Visalia. In San Joaquin County the rate in the western city of Tracey was nine times that of the more eastern part of the county. In Kings County the four year average rate on the west side was 844/100,000 compared with the Kings County rate of 52/100,000. In Fresno County the seven year average rate in the Coalinga area in western Fresno County was 2,457/100,000 compared with the Fresno County rate of 49/100,000. (Most, but not all, of the observed rate increase in both Fresno and Kings Counties was attributed to cases identified in the state prisoners.) In Kern County the average rate calculated between 2005 and 2010 for the mountain and desert regions were 42.0 and 53.0 per 100,000, respectively. Compared to the western, central valley, and north central valley regions the average rates per 100,000 were 261.9, 163.6, and 185.6, respectively. Thus, the increased risk for residents of the western part of Kern County was 6.2, 4.9, 1.4 and 1.6 times greater than for residents living in the mountain, desert, north central valley, and the central valley regions of Kern County. Kern County did remove the effect of prison cases for these regional calculations.

PRISON INMATES:

Only Tulare County is without a state or federal prison within the county. Although there are six institutions in Kern County, coccidioidomycosis in state and federal prisoners has a modest influence on Kern County data. The observed incidence rates in several of the prisons in Kern County have been high. For example, the six year average rate of 1,179/100,000 at Taft Prison exceeds the six year average for Kern County of 158/100,000. For the period 2005-2008 inmate cases in Kern County accounted for only 8% of the reported cases. Affected state prisoners have influenced the gender and race/ethnicity of cases somewhat in San Luis Obispo. In Kings and Fresno Counties male state prisoners have experienced remarkably high rates of coccidioidomycosis. The disease rates in

prisoners in these two counties has influenced the age, race/ethnicity and gender distributions in the two counties.

For the period 2004-2010 state inmates at Pleasant Valley State Prison represented 1% of the population of Fresno County but accounted for 43% of the reported cases. The average annual incidence rate for this period was 4,392/100,000. The rate in 2006 was almost 10%. In Kings County for the period 2007-2010, state prisoners represented 14% of the county's population but accounted for 58% of the cases reported in the county. Of the three prisons in the county, the inmates at Avenal State Prison represented 32% of the inmate population but accounted for 87% of the inmate cases. Avenal State Prison and Pleasant Valley State Prison are located in western side of the San Joaquin Valley and are approximately 15 miles apart.

CASES BY CLINICAL ILLNESS:

In general, limited data was presented on the clinical illness or morbidity and mortality from the six counties. San Joaquin County reported that 59% of their reported cases required hospitalization, 12% were disseminated and 8.7% had a fatal outcome. San Joaquin County also reported that 23% of their cases had diabetes as a co-morbid condition. Fresno County presented data from 50% of their 2010 reported cases. Over 36% of the cases were hospitalized and 75% reported having at least three provider visits.

VARIATION BY REPORTING YEAR:

All counties have noted marked variability of cases by reporting year. The variation in reported cases is not consistent between the counties. For example, Kern and Kings experienced a spike in cases in the latter part of 2010. This spike in cases was less pronounced in San Luis Obispo, San Joaquin and Fresno Counties. Tulare experienced no increase in 2010. These variations by year are unexplained in every county.

GENDER:

As has been noted in the literature, males are disproportionately affected by this disease. Males clearly are at risk for complicated coccidioidomycosis, especially meningitis. Males have also been recognized as being at increased risk for any form of the disease. The incremental increased risk for any disease is lower than that for complicated disease. The cause of the observed increased risk in males remains unknown. The distribution of cases by gender is noted in Table 2. Fresno, Kings, and San Luis Obispo Counties reported that over 70% of their cases occurred in men (range: 71% - 83%). In these three counties, this disproportionate rate in males is explained by the large number of male prisoners diagnosed with this disease. The gender distribution in the remaining three counties is less disparate although still noteworthy.

Table 2

% OF CASES BY GENDER BY COUNTY

County	Number	Percentage - Female	Percentage - Male
Fresno	3,160	20	80
Kern	7,652	42	56
Kings	854	17	83
San Joaquin	616	31	69
San Luis Obispo	993	29	71
Tulare	1,589	40	60

RACE AND ETHNICITY:

Race and ethnicity is a well recognized risk factor for disseminated disease. For example, African-Americans may have a dissemination rate that is at least 10 times that of non-Hispanic whites. In addition, there are studies in the literature that also suggest that some racial/ethnic groups also are at higher risk for developing any Coccidioides disease. The racial/ethnic distribution of cases for the six counties was predominately white and Hispanic. For racial/ethnic groups that have been identified as having an increased risk for disseminated disease, the small number of cases and relatively small populations in these communities make calculated rates unstable. To date none of the counties have looked at race/ethnic rates by area of the county.

In four of the six counties the collection of race/ethnicity data on the cases has been suboptimal (see Table 3). While San Joaquin and San Luis Obispo Counties collected race and ethnicity data on all but 3% of their cases, the remaining four counties reported between 13% and 56% of their cases were missing race/ethnicity data. This missing data further complicates analysis of cases by race and ethnicity.

Table 3

% OF CASES WITH UNKNOWN RACE

County	Percent
Fresno	16%
Kern	56%*
Kings	16%
San Joaquin	3%
San Luis Obispo	3%
Tulare	13%
*Kern County relies on serology for reporting	

All counties presented frequency of cases by race/ethnicity however only Tulare reported rates by race/ethnicity. While an increased rate was observed in Tulare County in African-Americans and in Asians, the number of cases in each of these categories was small. The observed rate in Hispanics appeared higher than in non-Hispanic whites but the Hispanic designation may have included other racial groups. Kings County reported a disproportionate frequency of cases in African-Americans but not in Hispanics. However, both Tulare and Kings Counties had a fairly high rate of unknown race/ethnicity. The group determined that most of us need to improve our collection of race/ethnicity data including lessons learned from San Joaquin and San Luis Obispo Counties.

AGE:

When cases were presented by age group, every county reported that children were underrepresented. In most counties the highest frequency of cases was seen in the middle aged adults. Tulare County was the jurisdiction that presented rates per 100,000 by age group. The highest rate for Tulare County

was observed in the 60-69 year old age group. Again, the influence that state inmates had on the age distribution of cases in Fresno and Kings County skew the distribution towards the younger age groups.

OTHER OBSERVATIONS:

None of the counties felt that the 2010 mandate for laboratory reporting had affected their surveillance numbers to date. It was suggested that laboratory reporting may be useful in identifying cases that later develop disseminated or complicated disease. The group felt that the assessment of the impact of laboratory reporting was premature.

Kern County presented aerial photographs of areas of the county that appears to be highly endemic. These areas have large areas of undeveloped, non-farm land.

The group noted that the all the major north-south highways in California traverse the highly endemic areas of several of the counties. Highway 101 passes through highly endemic areas of San Luis Obispo County. Highway 99 passes through moderately endemic areas of Tulare and Kern Counties. Highway 5 passes through highly endemic areas of Fresno, Kings and Kern Counties. The group acknowledged that the literature documents that infection with *Coccidioides spp.* can occur with very limited exposure in endemic areas.

Because most of the clinical manifestations of coccidioidomycosis are nonspecific and the diagnosis requires specific laboratory testing, it is reasonable to assume that travelers through endemic areas of California are an under-recognized population at high risk for coccidioidomycosis. For the population that travels through the endemic areas as a condition of employment, unrecognized coccidioidomycosis likely deprives some workers of worker compensation benefits.

FUTURE DIRECTIONS:

The group recognizes that data collection can be cumbersome for both community providers and for local health departments. With this in mind the group committed to improving our surveillance of coccidioidomycosis by identifying a uniform data set to be collected in the participating counties. As noted previously, the group agreed that we need to improve our collection of race/ethnicity data.

The group discussed the value of encouraging the diagnosis and reporting of this disease. Although clinical drug trials have not been performed to demonstrate that early treatment of uncomplicated coccidioidomycosis may prevent severe pulmonary or dissemination of this disease, there are at least four benefits to diagnosis and reporting the disease. First, diagnosing early infection provides the patient with an answer to why they are feeling so poorly. Second, it prevents unnecessary diagnostic testing. Third, it prevents the unnecessary use of antibiotics, drugs that have no effect on patient's illness. It has been reported that at least 81% of patients who develop coccidioidomycosis pneumonia receive at least one course of antibiotics and that 31% receive multiple courses for their illness. Finally, follow-up by providers should facilitate the early recognition and management of complications, especially the early management of meningitis.

In conclusion, on May 13, 2011, Kern, Kings, San Joaquin, San Louis Obispo (SLO), San Joaquin and Tulare Counties met to discuss and present data on coccidioidomycosis. We think it is likely that the observed incidence in the six counties is an under-estimate. We speculate that a large population of nonresidents are at risk for infection but aren't diagnosed because of diagnostic challenges. Kern and Kings Counties clearly reported that the number of cases and case rates for 2010 were unusually high. Furthermore, requiring coccidioidomycosis to be reported by laboratories did not influence/change this finding. In addition, collecting standardized data in these counties is a priority for counties in this

region, as well as, improving the completeness of case data on race/ethnicity. Finally, the group felt that it would be beneficial to meet annually to discuss and present their data.

APPENDIX

Population and Demographic Data by State and County

	California		Fresno		Kern		Kings	
AGE	N	Percent	N	Percent	N	Percent	N	Percent
Total Population	37,253,956	100.0%	930,450	100.0%	839,631	100.0%	152,982	100.0%
0-9 years	5,037,172	13.5%	154,020	16.6%	141,579	16.9%	24,441	16.0%
10-19 years	5,414,870	14.5%	156,715	16.8%	140,966	16.8%	22,680	14.8%
20-29 years	5,510,358	14.8%	145,785	15.7%	128,969	15.4%	26,582	17.4%
30-39 years	5,147,047	13.8%	119,944	12.9%	112,974	13.5%	23,348	15.3%
40-49 years	5,298,950	14.2%	115,705	12.4%	109,821	13.1%	21,604	14.1%
50-59 years	4,766,848	12.8%	104,913	11.3%	95,833	11.4%	16,694	10.9%
60-69 years	3,135,755	8.4%	68,476	7.4%	59,092	7.0%	9,460	6.2%
70-79 years	1,738,749	4.7%	37,670	4.0%	32,017	3.8%	5,242	3.4%
80 years and over	1,204,207	3.2%	27,222	2.9%	18,380	2.2%	2,931	1.9%
RACE								
One Race	35,438,572	95.1%	888,164	95.5%	801,775	95.5%	145,490	95.1%
White	21,453,934	57.6%	515,145	55.4%	499,766	59.5%	83,027	54.3%
Black	2,299,072	6.2%	49,523	5.3%	48,921	5.8%	11,014	7.2%
American Indian	362,801	1.0%	15,649	1.7%	12,676	1.5%	2,562	1.7%
Asian	4,861,007	3.2%	89,357	9.6%	34,846	4.2%	5,620	3.7%
Filipino	1,195,580	3.2%	9,720	1.0%	15,948	1.9%	3,664	2.4%
Native Hawaiian or Other Pacific	144,386	0.4%	1,405	0.2%	1,252	0.1%	271	0.2%
Other	6,317,372	17.0%	217,485	23.4%	204,314	24.3%	42,996	28.1%
Two or More Races	1,815,384	4.9%	42,286	4.5%	37,856	4.5%	7,492	4.9%
HISPANIC OR LATINO								
Hispanic or Latino (of any race)	14,013,719	37.6%	468,070	50.3%	413,033	49.2%	77,866	50.9%
Not Hispanic or Latino	23,240,237	62.4%	462,380	49.7%	426,598	50.8%	75,116	49.1%

AGE	San Joaquin		San Luis Obispo		Tulare		Combined	Percentage of California
	N	Percent	N	Percent	N	Percent	N	Percent
Total Population	685,306	100.0%	269,637	100.0%	442,179	100.0%	3,320,185	8.9%
0-9 years	109,038	15.9%	27,116	10.1%	81,024	18.3%	537,218	10.7%
10-19 years	114,547	16.7%	35,928	13.3%	77,969	17.6%	548,805	10.1%
20-29 years	94,681	13.8%	44,710	16.6%	64,713	14.6%	505,440	9.2%
30-39 years	89,494	13.1%	28,880	10.7%	57,373	13.0%	432,013	8.4%
40-49 years	93,303	13.6%	34,195	12.7%	53,954	12.2%	428,582	8.1%
50-59 years	82,014	12.0%	40,715	15.1%	46,969	10.6%	387,138	8.1%
60-69 years	53,437	7.8%	29,435	10.9%	31,501	7.1%	251,401	8.0%
70-79 years	28,716	4.2%	16,157	6.0%	17,525	4.0%	137,327	7.9%
80 years and over	20,076	2.9%	12,501	4.6%	11,151	2.5%	92,261	7.7%
RACE								
One Race	641,511	93.6%	259,524	96.2%	423,755	95.8%	3,160,219	8.9%
White	349,287	51.0%	222,756	82.6%	265,618	60.1%	1,935,599	9.0%
Black	51,744	7.6%	5,550	2.1%	7,196	1.6%	173,948	7.6%
American Indian	7,196	1.1%	2,356	0.9%	6,993	1.6%	47,432	13.1%
Asian	98,472	14.4%	8,507	3.2%	15,176	3.4%	251,978	5.2%
Filipino	35,476	5.2%	2,906	1.1%	5,605	1.3%	73,319	6.1%
Native Hawaiian or Other Pacific	3,758	0.5%	389	0.1%	509	0.1%	7,584	5.3%
Other	131,054	19.1%	19,786	7.3%	128,263	29.0%	743,898	11.8%
Two or More Races	43,795	6.4%	10,113	3.8%	18,424	4.2%	159,966	8.8%
HISPANIC OR LATINO								
Hispanic or Latino (of any race)	266,341	38.9%	55,973	20.8%	268,065	60.6%	1,549,348	11.1%
Not Hispanic or Latino	418,965	61.1%	213,664	79.2%	174,114	39.4%	1,770,837	7.6%