

### Key Findings and Public Health Messages

- The California Department of Public Health (CDPH) received reports of 43 confirmed and 61 probable cases of cysticercosis with estimated dates of illness onset in 2009 through 2012. This corresponds to an incidence rate of 0.07 per 100,000 population per year.
- Cysticercosis incidence decreased by 33.3 percent from 2009 (34 cases; 0.09 per 100,000 population) to 2012 (24 cases; 0.06 per 100,000 population).
- Incidence rates during the surveillance period were highest among persons 25 to 34 years of age (0.14 per 100,000 population per year) and 35 to 44 years of age (0.10 per 100,000 population per year).
- Hispanic ethnicity was reported more frequently (89.7 percent) for cysticercosis case-patients than expected from the proportion of Hispanics in the general California population (37.8 percent).
- Identification of a patient with cysticercosis warrants evaluation of other household members for both cysticercosis and taeniasis to rule out possible local transmission.

### Background

Cysticercosis is one of two forms of infection caused by the tapeworm, *Taenia solium*. *Taenia solium* is a parasite of both humans and pigs, and requires both species to complete its life cycle. People who eat pork containing *T. solium* cysts (cysticerci) develop an intestinal infection

with the adult tapeworm called taeniasis. Persons with taeniasis pass tapeworm eggs in their feces. When these eggs are consumed by a pig, the eggs hatch in the intestine, releasing larvae that migrate and encyst in tissues. Cysticercosis occurs when people ingest tapeworm eggs directly, and, as in pigs, the larvae migrate out of the intestine and into muscle and other organs and tissues. Neurocysticercosis occurs when larvae form cysticerci in the brain, causing headache, seizures, signs of intracranial hypertension, or psychiatric disturbances.<sup>1,2</sup>

Worldwide, *T. solium* cysticercosis and taeniasis are endemic in developing countries in Latin America, sub-Saharan Africa, and Asia. In the United States, regulations and food animal husbandry practices have virtually eliminated the parasite from commercial pork.

Neurocysticercosis cases diagnosed in the U.S. have been mainly among immigrants from Mexico and Latin America; however, occasional disease acquired within the U.S., including in California, has been reported.<sup>3</sup>

We describe here the epidemiology of confirmed and probable cysticercosis cases in California with estimated onset dates from January 2009 through December 2012 reported to CDPH by March 2015. Data for 2012 are provisional and may differ from data in future publications. For a complete discussion of the definitions, methods, and limitations associated with this report, please refer to Technical Notes.<sup>4</sup>

### California reporting requirements and surveillance case definition

During the surveillance period, a confirmed case was defined as clinically compatible illness with at least one of the following confirmatory laboratory/imaging criteria:

- *Taenia solium* identified by microscopic examination in cysticerci excised from tissues; or
- identification of cysticerci by computerized tomography (CT) scan, magnetic resonance imaging (MRI), or X-ray; and positive result on Centers for Disease Control and Prevention (CDC) immunoblot assay

A probable case was defined as clinically compatible illness with at least one of the following supportive laboratory/imaging criteria:

- identification of calcified cystic lesions in tissue by CT scan, MRI, or X-ray; or
- positive result on CDC immunoblot assay

### **Epidemiology of cysticercosis in California**

CDPH received reports of 43 confirmed and 61 probable cases of cysticercosis with estimated illness onset dates from 2009 through 2012. This corresponds to an incidence rate of 0.07 per 100,000 population per year.

Reported cysticercosis incidence decreased by 33.3 percent from 2009 (34 cases; 0.09 per 100,000 population) to 2012 (24 cases; 0.06 per 100,000 population) [Figure 1]. During the surveillance period, two (1.9 percent) fatal cases were reported.

Reported cysticercosis incidence rates during the by estimated year of illness onset, surveillance period were highest among persons 25 to 34 years of age (0.14 per 100,000 population per year) and 35 to 44 years of age (0.10 per 100,000 population per year) [Figure 2]. The ratio of male to female case-patients was 1.6:1.0. Cysticercosis cases with complete information on race/ethnicity (93.3 percent of all cases) reported Hispanic (89.7 percent) ethnicity more frequently than would be expected based on the proportion

of Hispanics (37.8) in the California general population [Figure 3].

The incidence for cysticercosis was 1.3 times higher in Southern California (0.08 per 100,000 population per year) than in Northern California (0.06 per 100,000 population per year). However; the highest incidence during the surveillance period was in the Central Coast (0.14 per 100,000 population per year) [Figure 4].

Figure 1. California cysticercosis case counts and incidence rates by estimated year of illness onset, 2001-2012\*

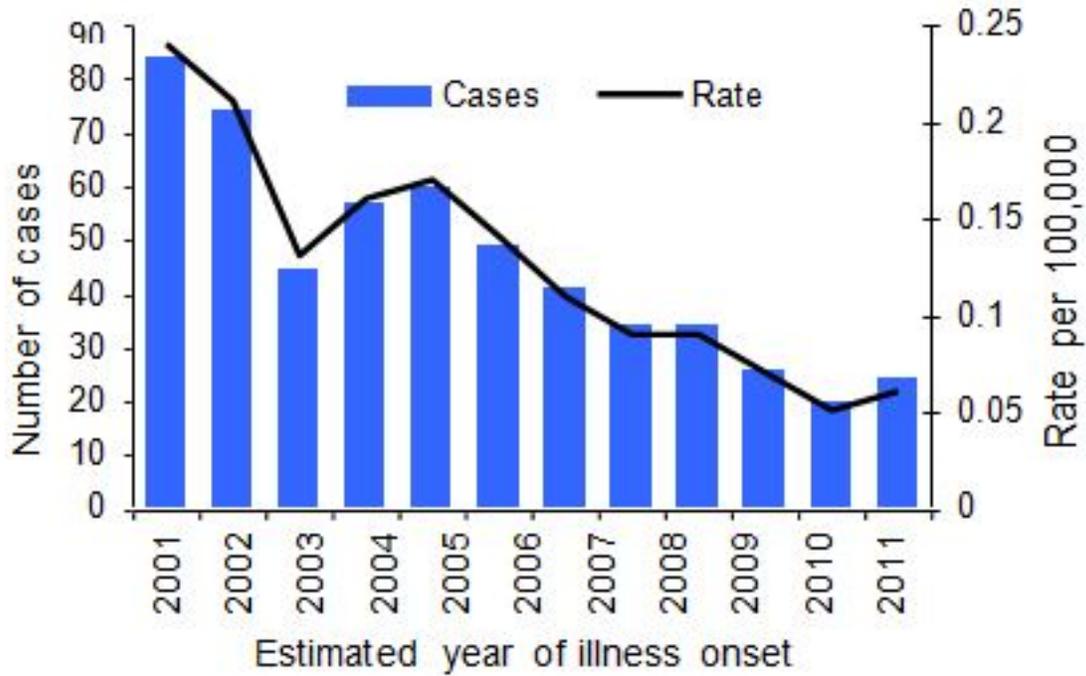


Figure 2. California cysticercosis incidence rates by age groups, 2009-2012\*

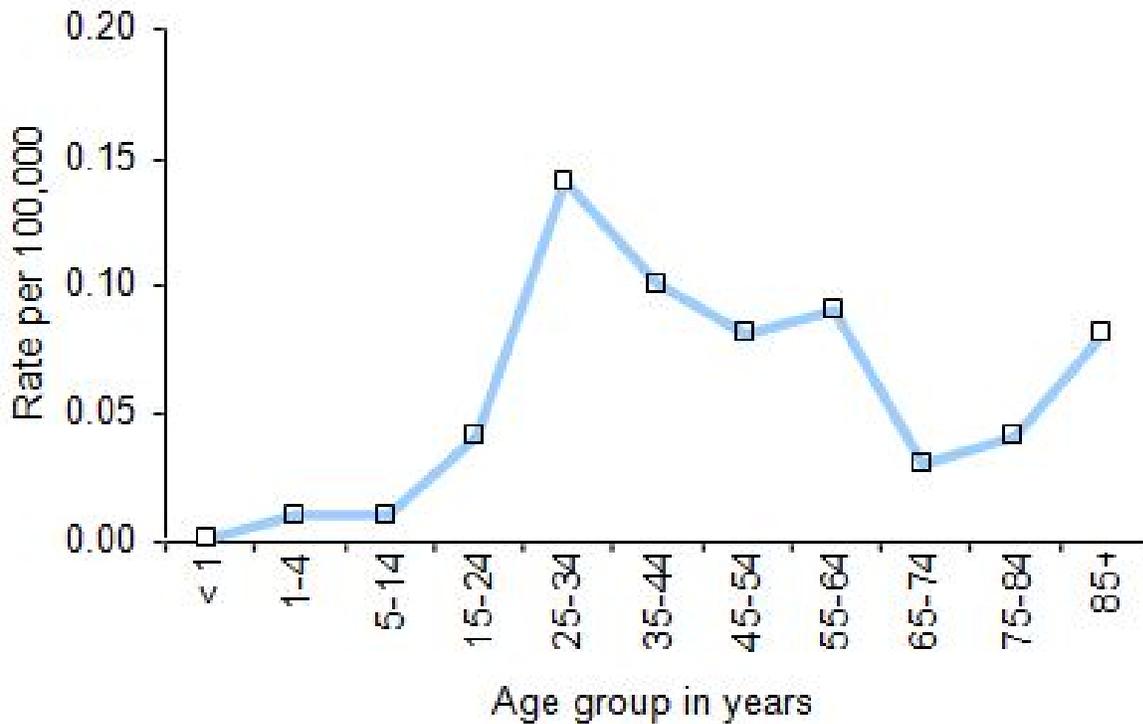
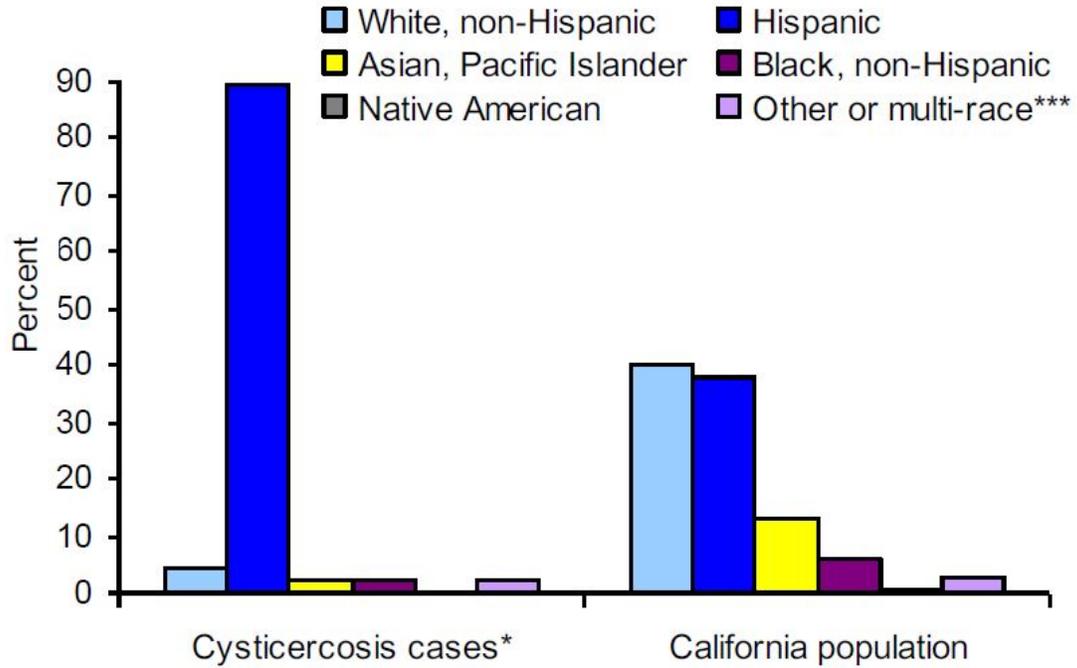


Figure 3. California cysticercosis cases and population by race/ethnicity, 2009-2012\*



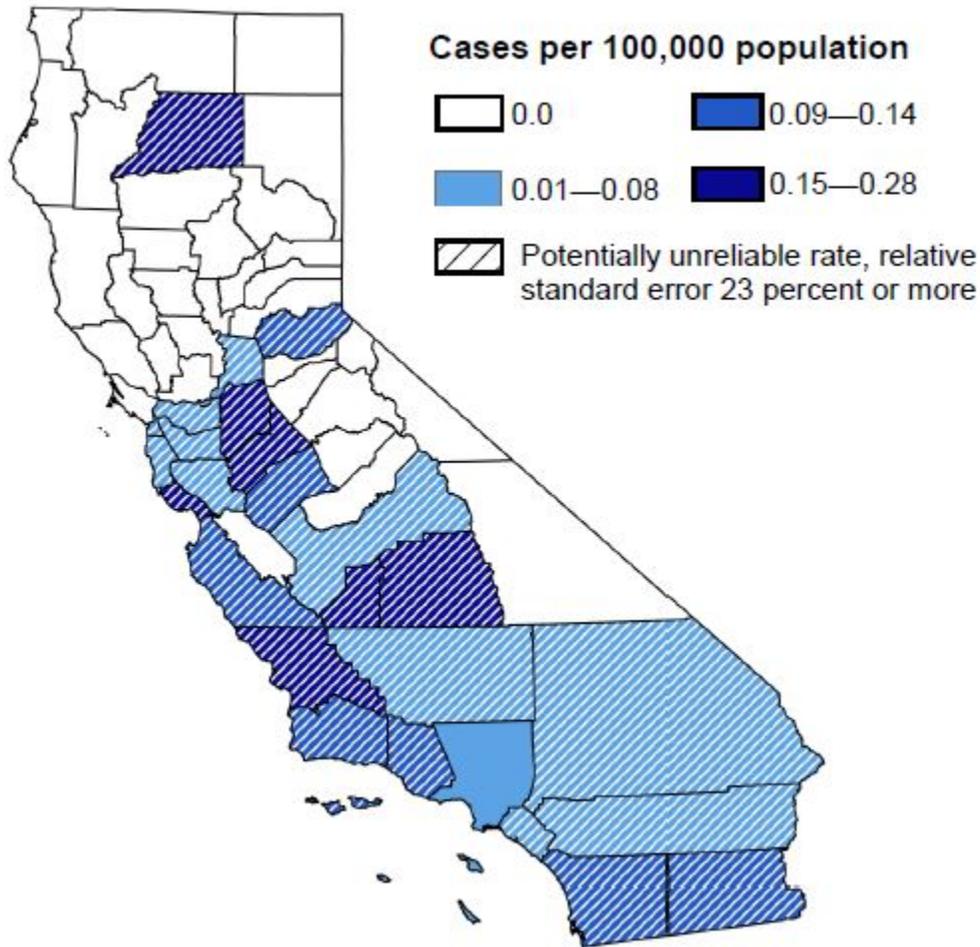
**Notes for Figures 1-4**

\*2012 data are provisional

\*\* Unknowns were excluded

\*\*\* Includes cases who identified "other" as their race and Californians ('population') who identified more than one race

Figure 4. California county-specific cysticercosis incidence rates, 2009-2012\*



**Comment**

Overall, reported incidence of cysticercosis in California has decreased since 2001. The higher frequency of the disease among persons of Hispanic ethnicity is consistent with the historical finding of this disease being more common among immigrants from Latin America. Because cysticercosis is a result of ingestion of *T. solium* eggs from the feces of an infected human, washing hands with soap and water after using the toilet and before handling food is important in the prevention of this disease. Persons with taeniasis should refrain from preparing food until treatment has cleared their infection.

cysticercosis depend on both the number of encysted larvae and the particular tissues affected, infection may remain subclinical for months to years. Calcified cysts may be recognized only as incidental findings on imaging studies. Because of the potentially protracted period between exposure and diagnosis the circumstances leading to infection for a given case-patient are frequently difficult to identify and past the point of purposeful public health intervention. Nevertheless, identification of a patient with cysticercosis warrants evaluation of other household members for both cysticercosis and taeniasis to identify persons who may have acquired infection from, or been exposed to the same source as, known household case-patients.

Because clinical manifestations of

For travelers visiting endemic countries, intestinal infection with *T. solium* (taeniasis) and cysticercosis can be prevented by avoiding pork that has not been thoroughly cooked and foods that may be contaminated with human feces.

## References and resources

<sup>1</sup>[CDC Parasites - Cysticercosis:](http://www.cdc.gov/parasites/cysticercosis/index.html)  
(<http://www.cdc.gov/parasites/cysticercosis/index.html>)

<sup>2</sup>[CDPH Cysticercosis \(Pork Tapeworm, Taeniasis\):](http://www.cdph.ca.gov/HealthInfo/discond/Pages/Cysticercosis.aspx)  
(<http://www.cdph.ca.gov/HealthInfo/discond/Pages/Cysticercosis.aspx>)

<sup>3</sup>Cantey PT, Coyle CM, Sorvillo FJ, Wilkins PP, Starr MC, Nash TE. Neglected parasitic infections in the United States: Cysticercosis. *Am J Trop Med Hyg* 2014; 90:805-809.

<sup>4</sup>[Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001 - 2008 and 2009 - 2012: Technical Notes](http://www.cdph.ca.gov/programs/sss/Documents/TechnicalNotes01-08and09-12.pdf)  
(<http://www.cdph.ca.gov/programs/sss/Documents/TechnicalNotes01-08and09-12.pdf>)

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