

**San Francisco Bay Area  
Cryptosporidiosis Surveillance Project**

**Timeliness of Cryptosporidiosis Notification  
2005 & 2006**

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## Introduction

First recognized as a human pathogen in 1976, *Cryptosporidium* is a protozoan parasite that normally causes mild diarrheal disease in healthy individuals but may be life threatening for the immunocompromised. *Cryptosporidium* oocysts appear in the stool 1 to 12 days post exposure with the onset of symptoms and can last for weeks following symptom resolution. Oocysts are infective immediately upon excretion, persist in the environment and are extremely resistant to disinfection with chlorine or monochloramine. Transmission occurs via direct oral-fecal contact or through contact with oocyst-infected human or animal waste contaminated fomites, food or water.<sup>1</sup> *Cryptosporidium* is one the most common causes of waterborne disease and oocysts have been detected in trace amounts in raw and treated drinking water.<sup>2,3</sup>

The San Francisco Bay Area Cryptosporidiosis Surveillance Project (CSP), operating since June 1996, is a joint project between the San Francisco Public Utilities Commission (SFPUC) and Bay Area health departments. In 1989, the Environmental Protection Agency promulgated the Surface Water Treatment Rule mandating all drinking water systems supplied by surface water sources to add filtration to their water processing or to demonstrate the ability to provide high quality drinking water without filtration.<sup>4</sup> SFPUC is one of 5 large water utilities with a surface water supply of sufficiently high quality that filtration is not necessary. In lieu of filtration, water utilities must continuously demonstrate their water to be of the highest standards, maintain source water protection programs and monitor for waterborne illness among their customers. The San Francisco Bay Area Cryptosporidiosis Surveillance Project is an essential part of the SFPUC's water filtration avoidance agreement with the EPA.

At its inception, CSP was managed by the California Emerging Infections Program (CEIP) and monitored cryptosporidiosis incidence in eight Bay Area counties: Alameda, Contra Costa, San Francisco, Marin, San Mateo, Santa Clara, Solano, and Sonoma.<sup>5</sup> Surveillance began in Tuolumne County in June 1999. In 2002, CEIP discontinued surveillance in Marin, Solano, and Sonoma counties. Since June 2003, the San Francisco Department of Public Health (SFDPH) has been coordinating cryptosporidiosis surveillance for the four counties served by the SFPUC: Alameda, San Francisco, San Mateo, Santa Clara, and Tuolumne County where the Hetch Hetchy reservoir, which provides 85% of SFPUC's source water, is located.

CSP is an active surveillance project, using phone, email, and fax to obtain laboratory reports of confirmed cryptosporidiosis. There are three main goals of the project: to enhance reporting of human cases of cryptosporidiosis, to monitor trends over time, and to detect increases in the number of reported cases or outbreaks early enough to allow timely investigation and possible intervention. In addition to human disease monitoring, CSP works closely with the SFPUC to address health risks associated with waterborne *Cryptosporidium* oocysts.

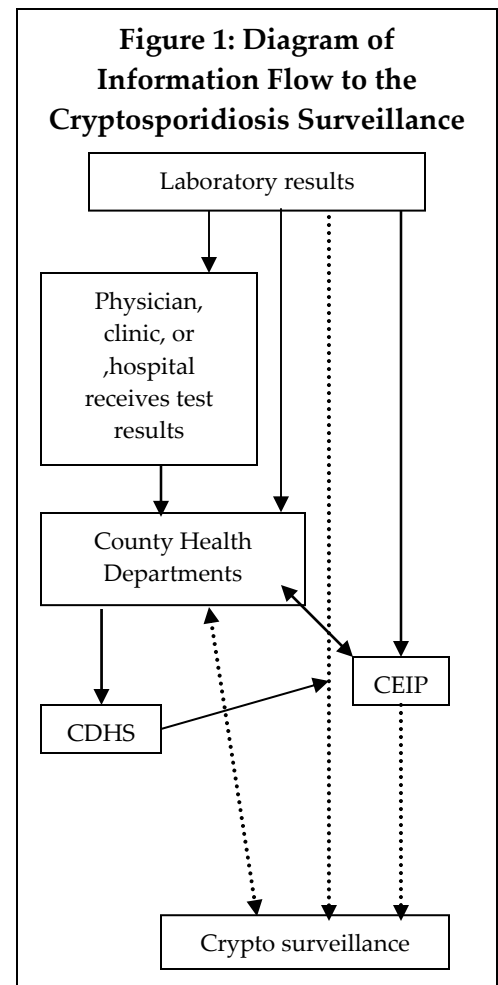
## Cryptosporidiosis Surveillance Reporting

While Title 17, section 2505 of the California Code of Regulations mandates reporting of cryptosporidiosis cases to local health departments within one working day, participation in CSP is voluntary. CSP staff identified nineteen locally operated laboratories serving Tuolumne, Santa Clara and San Mateo Counties. (Table 1) Of these, thirteen laboratories report to CSP; six of the thirteen laboratories perform regular in-house testing for *Cryptosporidium*, seven send specimens out to non-participating labs. Three additional laboratories send specimens to participating labs who report to CSP for them. Three laboratories, two of which are associated with participating health departments, declined to participate. No national laboratories have agreed to participate in CSP. Typical specimen processing time ranges from hours up to three days. Factors such as whether a laboratory has in-house testing capabilities and batch testing procedures influence the processing time. Upon confirmation of test results, participating laboratories fax case reports to CSP. CSP maintains regular monthly contact with the laboratories to obtain information regarding testing patterns.

Direct reporting	
In-house testing	6
Sends out for testing	7
Report via other participating lab	3
Refused to participate	3
<b>Total</b>	<b>19</b>

CEIP maintains the Foodborne Diseases Active Surveillance Network, an active laboratory surveillance system monitoring for a number of potentially foodborne pathogens including *Cryptosporidium*. The catchment area for this surveillance system includes San Francisco and Alameda Counties, where the majority of cryptosporidiosis cases in the five CSP-participating counties reside. To reduce the burden associated with reporting, laboratories serving clients in these counties report positive cryptosporidiosis cases to the respective health departments and CEIP only. Upon receipt of the reports, CEIP forwards cases to CSP and to be thorough, to their respective county health departments. CEIP faxes copies of confidential morbidity reports to CSP on an ongoing basis. Additionally, once a month, CEIP mails CSP a file containing all cryptosporidiosis cases to-date. CEIP also forwards quarterly case lists to CSP from the California Department of Health Services (CDHS).

While CSP is a laboratory based surveillance system, cooperation with local health departments ensures more complete and timely reporting. Participation in CSP by the local health departments in the SFPUC service area varies. CSP maintains direct, reciprocal, contact with the San Mateo, Santa Clara and the Tuolumne County Health Departments; as cases occur and are reported, they are forwarded in between CSP and the respective health departments. Case



reports from San Francisco County are retrieved weekly in person from the offices of the San Francisco Communicable Disease Control Unit (CDCU). Due to staffing and procedural changes occurring in the third quarter of 2005 and lasting through the first half of the first quarter of 2006, most of San Francisco County cases during that time were reported to CSP by participating laboratories or CEIP. CSP has no formal case reporting relationship with Alameda County; participating laboratories or CEIP reports most cases from Alameda County.

One of the goals of public health surveillance is to detect cases and to discover their etiologies early enough to prevent subsequent exposure and illness. Therefore, reflection on the timeliness of any surveillance system should be a priority. This analysis examines the time necessary for case reporting to CSP in 2005 and 2006 from all sources and also examines each source separately. This report also includes an assessment of the completeness of reporting to CSP in 2006.

## Methods

Data for the analysis were extracted from individual case and lab reports, CEIP monthly reports, and CEIP-forwarded CDHS case lists received by CSP with a specimen collection date between January 1, 2005 and December 31, 2006. For San Francisco case reports obtained through direct CSP/CDCU cooperation, the date of arrival to CDCU was used as the date of arrival to CSP. San Francisco reports that arrived in the absence of active CSP /CDCU case sharing were recorded only at their actual arrival to CSP. For mailed electronic CEIP data for which the exact date of arrival to CSP was not known, the file creation date for the earliest occurrence of a case was used. In the event that a case was reported more than once, only the earliest report was used. For the purposes of the analysis, reports generated following confirmatory or subsequent testing for an already-reported patient were considered given the reports had unique specimen collection dates. In 2005 and 2006, CSP received a total of 177 case reports. Of these, one case reported by CEIP, a resident of San Francisco in 2005, lacked date of arrival information and was excluded from the analysis. The analysis includes one hundred and seventy-six case reports.

To determine the lag time in cryptosporidiosis case reporting, the median number of days from the date of specimen collection to arrival at CSP was determined. Generally, a date of diagnosis was not available; instead, the specimen collection date was employed as the earliest date possible for reporting purposes. Informal interviews with participating laboratories revealed a zero to three day turn-around time for *Cryptosporidium* specimens. Therefore, the specimen collection date generally overestimates the time to reporting.

Completeness of reporting in 2006 was assessed by comparing cases reported to CSP to those reported to CDHS. CDHS cryptosporidiosis reports sent to CSP via CEIP were used to determine which cases were reported to CDHS. The total number of cryptosporidiosis cases in the five participating Bay Area counties, including those not reported, was estimated using the following formula:  $N = n_{\text{CSPonly}} + n_{\text{CDHSonly}} + n_{\text{CDHS\&CSP}} + (n_{\text{CSPonly}} * n_{\text{CDHSonly}}) / n_{\text{CDHS\&CSP}}$

## Results

### By Year

The overall median days-to-reporting for 2006 for 113 cases, was 4 days. (Table 2) This represents a substantial decrease in reporting time over 2005 when the median days-to-reporting for 63 case reports was 10 days. Figures 2 and 3 show frequencies for days-to-reporting in 2006 and 2005.

### By Quarter

To determine if time-to-reporting varied throughout the year, data were examined by quarters. (Table 3) Median time between lab diagnosis and report to CSP in 2005 varied from 19 days in the first quarter to a low of 5 days in the third quarter. In 2006, following a high of 29 days-to-reporting in the first quarter, the median days-to-reporting fell to 8 days in the second quarter and then to 4 days for both the third and fourth quarters. The reduction in days-to-reporting between the first and second quarter is partially due to a restoration of case sharing between CSP and CDCU; CEIP reported all 11 San Francisco cases in the first quarter but only 2 during quarters two through four. Increased awareness following a late summer cryptosporidiosis outbreak in Santa Clara County may have kept reporting time low throughout the second half of 2006.<sup>6</sup>

### By Informant

The median days-to-reporting for most informant types fell in 2006 as compared to 2005. The exception was physician-reported cases, which increased from 4 days in 2005 to 22 days in 2006. Reporting time by informant is shown in Table 4. In 2006, most cases were reported to CSP by participating laboratories or via a county health department; 37 of the 39 County health department reported cases were reported by the Santa Clara County Department of Health. The median days-to-reporting for laboratory and health department reported cases was 4 days each. CEIP reported 26 cases to CSP; the median number of days for CEIP-reported cases to arrive to CSP was 12 days. In 2006, only 1 case was reported to the CDHS prior to CSP; the case was reported 17 days following specimen collection.

Year	Days	Range	Number of Cases
2005	10	1, 143	63
2006	4	1, 64	113

Reporting time varied significantly between 2005 and 2006.

Year	Quarter	Days	Range	Number of Cases
2005	Q 1	19	4, 112	15
	Q 2	8	1, 128	18
	Q 3	5	1, 79	18
	Q 4	12	3, 143	12
2006	Q 1	29	4, 64	20
	Q 2	8	1, 22	8
	Q 3	4	1, 14	75
	Q 4	4	1, 19	10

Year	Informant	Days	Range	Number of Cases
2005	Laboratory	7	1, 32	30
	CEIP	23	3, 128	25
	Physician*	4	N/A	1
	County Health Department <sup>††</sup>	8	3, 18	4
	CDHS***	131	32, 143	3
2006	Laboratory	4	1, 19	46
	CEIP	12	2, 64	26
	Physician*	22	N/A	1
	County Health Department**	4	1, 14	39
	CDHS***	17	N/A	1

\* Reported through the CDCU  
 \*\* Includes cases from Alameda, San Mateo, and Santa Clara Counties  
 \*\*\* Reported through CEIP  
 † Includes cases from San Mateo County

**By County:**

Like 2005, in 2006 San Mateo County had the quickest overall reporting with a median of 3 days-to-reporting. Santa Clara County had a median days-to-reporting of 4 days. The median days-to-reporting for Alameda County in 2006 was 5; in 2005 it took over 27 days for 50% of cases to be reported from Alameda County. San Francisco County, with a median of 12 days-to-reporting had the slowest overall reporting to CSP. Time-to-reporting by County, informant and quarter for 2006 and 2005 is shown in Table 5.

Time-to-reporting for San Francisco varied widely depending on the CSP informant. In 2006, the overall reporting time for San Francisco was 12 days, however, the median days-to-reporting for quarters 2 through 4, after CSP/ CDCU cooperation was enhanced, was only 8 days. The median days-to-reporting for laboratory-reported cases was 4 days. In both 2005 and 2006, San Francisco cases reported by CEIP had a median days-to-reporting of more than 30 days post specimen collection. San Francisco County reporting times by informant and quarter were lower in 2006 than 2005.

In 2006 CEIP reported most of the cases from Alameda County; cases reported through CEIP arrived at a median of 6 days post specimen collection. Five cases were reported by diagnostic laboratories with a median days-to-reporting of 5 days, and only one was reported directly from the Alameda County Department of Public Health. One case arriving through CDHS took 17 days to be reported to CSP. 2006 Alameda County data by quarter shows a large reduction in days-to-reporting following the first quarter.

San Mateo County cases are typically reported first by participating laboratories. Year to year, the median number of days-to-reporting from all sources for San Mateo County is consistently low. In 2006, the median number of days-to-reporting by laboratory informant was 3 days, by health department was 5 days and the only case arriving via CEIP took 8 days to be reported to CSP.

In 2006 Santa Clara County Public Health Department reported the majority of cryptosporidiosis cases, 37, to CSP from that county. CEIP and participating laboratories also reported cases. Cases reported directly by laboratories or via the health department arrived with a median of 4 days-to-reporting. CEIP cases were reported at a median of 6 days post collection. Throughout 2006, reporting times for Santa Clara County were low with median days-to-reporting between 1 and 6 days per quarter.

**Table 5: Median Days Between Specimen Collection and Report to CSP, by County, Informant and Quarter**

County		Days (2006)	Range (2006)	Number of Cases (2006)	Days (2005)	Range (2005)	Number of Cases (2005)
<b>San Francisco</b>	CEIP	33	10, 64	13	32	7, 106	14
	Laboratory <sup>a</sup>	4	1, 19	14	11	1, 32	13
	DPH <sup>b</sup>	N/A	N/A	N/A	N/A	N/A	N/A
	CDHS <sup>c</sup>	N/A	N/A	0	N/A	N/A	N/A
	Physician <sup>d</sup>	22	N/A	1	4	N/A	1
	Q 1	41	10, 64	11	18	4, 41	10
	Q 2	10	2, 22	5	7	1, 29	8
	Q 3	4	2, 13	9	51	11, 79	4
	Q 4	11	2, 32	3	89	7, 106	5
	Q1-Q4	12	1, 64	28	15	1, 90	27
<b>San Mateo</b>	CEIP	8	NA	1	7	NA	1
	Laboratory	3	1, 10	14	3	1, 12	7
	DPH	5	N/A	1	7	3, 18	4
	CDHS <sup>c</sup>	N/A	N/A	0	N/A	N/A	N/A
	Physician	N/A	N/A	N/A	N/A	N/A	N/A
	Q 1	7	5, 8	2	N/A	N/A	0
	Q 2	N/A	N/A	0	7	N/A	1
	Q 3	2	2, 10	9	3	1, 12	9
	Q 4	4	1, 4	4	12	7, 18	2
	Q1-Q4	3	1, 10	15	5	1, 18	12
<b>Santa Clara</b>	CEIP	6	3, 7	3	7	5, 12	3
	Laboratory	4	2, 8	12	4	1, 30	7
	DPH	4	1, 14	37	N/A	N/A	N/A
	CDHS <sup>c</sup>	N/A	N/A	0	32	32	1
	Physician	N/A	N/A	N/A	N/A	N/A	N/A
	Q 1	6	4, 8	4	29	29, 30	2
	Q 2	1	N/A	1	6	1, 12	4
	Q 3	4	1, 14	45	5	3, 32	3
	Q 4	6	3, 7	3	5	3, 7	2
	Q1-Q4	4	1, 14	53	7	1, 32	11
<b>Alameda</b>	CEIP	6	3, 28	9	26	3, 128	9
	Laboratory	5	1, 7	6	8	7, 8	2
	DPH	2	2	1	N/A	N/A	N/A
	CDHS <sup>c</sup>	17	N/A	1	137	131, 143	2
	Physician	N/A	N/A	N/A	N/A	N/A	N/A
	Q 1	21	17, 28	3	26	8, 112	3
	Q 2	4	2, 6	2	34	7, 128	4
	Q 3	5	1, 14	12	4	3, 5	2
	Q 4	0	N/A	0	75	8, 143	4
	Q1-Q4	5	1, 28	17	26	3, 143	13

a Includes reports from participating laboratories and laboratory reports arriving through the CDCU.

b Due to the nature of the CSP/CDCU relationship all laboratory and physician generated reports arriving via CDCU are included with their respective categories.

c. CDHS cases are reported to CSP through the CEIP.

d The sole physician reported case arrived via the CDCU.

In 2005 and 2006, CSP did not receive any case reports for Tuolumne County residents. Tuolumne County has reported only one cryptosporidiosis case since surveillance began in 1996.

### **Reporting Completeness 2006**

Of the 113 case reports sent to CSP in 2006, only 1 arrived solely via the CDHS. Another 12 case reports were reported to CSP but not to CDHS. In comparing CSP data to CDHS case data, it appears that over 99% of cryptosporidiosis cases in the CSP study area were captured through surveillance.

### **Discussion:**

After the first quarter of 2006, quarterly median reporting times fell and remained at a low of 4 days. The reduction in reporting times may be attributed to a number of factors. During the first quarter of 2006, direct CSP-CDCU cooperation was re-established enabling direct reporting of San Francisco cases. Also, in February and again in October CSP held two emergency preparedness activities which likely increased reporting awareness among participants including local health departments and CEIP. Additionally, the multi-county cryptosporidiosis outbreak in August through October 2006 likely resulted in faster reporting in the third and fourth quarters.

The data used in the analysis have several limitations. Cryptosporidiosis is a rare disease and few cases are reported. Because of the small number of cases, calculations may not be stable, especially for sub-analyses. In the calculations for this analysis, the date laboratory tests were completed was generally not available and therefore, the specimen date was substituted as the earliest possible date for case reporting. Use of the specimen collection date overestimates time-to-reporting. An additional source of bias is that all calendar days, regardless of whether laboratories or health departments were open, were included in the time calculations, possibly leading to an overestimation. In determining the date of arrival for cases to CSP, cases reported during active CSP/CDCU case sharing were assigned the date of arrival to CDCU and electronic case files arriving via mail for which no other date was available were assigned the date of file creation. These methods for determining date of arrival likely underestimate the time actually necessary for reporting. Notwithstanding these limitations, cryptosporidiosis case reporting to CSP in all counties and by all informants required less time in 2006 than in 2005.

### References

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