Daily Situational Awareness Tool (DSAT): Utilizing real time infectious disease surveillance systems

Michael J. Leach, MPH [1]; Ho, Evelyn T., MPH [2]; McDonnell, Diana D., PhD [3]; Morrow, Scott, MD, MPH [1];

[1] San Mateo County Health Department, San Mateo, CA, [2] Stanford University School of Medicine, Stanford, CA

[3] University of California, Berkeley School of Public Health, Berkeley, CA

Abstract

The Daily Situational Awareness Tool (DSAT) is a highly condensed, one page snapshot of surveillance systems used in San Mateo County, designed to inform the Health Officer and key Health Department response staff of current infectious disease on a daily basis. Real-time surveillance is an important source of information in the San Mateo County Health Department's response to infectious disease. San Mateo County faces unique challenges in terms of disease control and prevention. Within the County is San Francisco International Airport, a main port of entry for travelers from many East Asian countries. In addition, the county has a mobile work force population and a high population density which can increase the spread of disease.

Information is gathered from surveillance systems that are updated daily. A range of sources provide a multi-layered picture of infectious disease in the county, providing both a short and long term view of disease patterns within the county. Surveillance systems include: emergency department volume (Emergency Department Census) for all six hospitals in the county, coded 911 call data in real-time (through First Watch), over the counter pharmaceutical data (through RODS), the National Bioterrorism Syndromic Surveillance Demonstration Project (NDP), school absenteeism data, unexplained death reports from the county coroner, San Francisco International Airport (SFO) CDC Quarantine Station reports, and other applicable communicable disease related incidents.

Each surveillance systems contributes a score, determined by specific threshold levels, to an overall daily score that corresponds to one of three color-coded levels of alert designed to provide key Health Department decision makers with a summary of infectious disease each day.

Methods

Thresholds and Alert Levels

There are three color-coded levels of alert for the DSAT: low (green), medium (yellow), and high (red). The three colors apply both to the individual surveillance systems and the overall DSAT. The color of alert level for each of the DSAT surveillance systems corresponds to a specific threshold. Thresholds for each alert level were determined based on the perceived public health concern. Each color-coded alert level is given a score: green is zero, yellow is one, and red is two.

Calculation of Overall DSAT Alert Level

The first part of the calculation that determines the overall DSAT alert level is category weight. Weight determination was based on discussions with the Health Officer on which surveillance systems have historically been the best indicators of disease in the county. Surveillance Systems are weighted as a six (the strongest compared to other systems), a two (a system that is 1/3 the strength of a system with a six), or a one (a system that is 1/6 the strength of a system with a six). Weight values assigned to each surveillance system were determined by testing different scenarios based on the overall response anticipated for each alert color.

The second part of the calculation is the individual color level. The individual color level is a daily value assigned to each surveillance system based on established thresholds. Green levels (low) are scored as a zero. Yellow levels (medium) are scored as a one. Red levels (high) are scored as a two.

The final part of the calculation is system strength, which is the sum of the sensitivity and specificity of each specific surveillance system. Sensitivity of a surveillance system is defined as the ability of the system to correctly identify relevant data. Specificity of a surveillance system is defined as the ability of the system to correctly identify irrelevant data.

Calculation of Overall Score

Daily DSAT Calculations

	Category Weight	Individual Color Level	Se	Sp	System Strength	Total
ED Census(6)	6	1	0.75	0.5	1.25	7.5
1st watch(6)	6	1	1	0.5	1.5	9
RODS(2)	2	2	1	0.5	1.5	6
Syndromic(2)	0	0	1	0.25	1.25	0
BioSense (2)	0	0	0.25	0.25	0.5	0
SFO(1)	1	0	0.25	0.25	0.5	0
Absenteeism(2)	0	0	0.75	0.25	1	0
Poison Control (1)	1	0	0.25	0.25	0.5	0
Pred. Max Temp(1)	1	0	0.25	0.25	0.5	0
Unexplained Death (1)	1	1	0.75	0.5	1.25	1.25
Total	18					23.5
Maximum Total						44.5
Minimum Total						0
Yellow Lower Bound						15
Red Lower Bound						30
Red	2					
Yellow	1					
Green	0					

Sample DSAT

Daily Situational Awareness Tool: October 12, 2007

Overall Alert Level: MEDIUM

ED Census: Alert Level = 515
- Green: ≤ 2 Standard deviations
- Yellow: >2 and <3 Standard deviations
- Red: > 3 Standard deviations

First Watch: Alert Level =
- Green: No Alerts
- Yellow: Alerts not pursued
- Red: Pursued Alerts

RODS: Alert Level =

unpromoted sale counts of antidiarrheal, cough/cold, thermometers
- Green: ≤ 1.5 Standard deviations above previous week's average
- Yellow: 1-2 days > 1.5 Std. Dev.
- Red: 2+ days > 1.5 Std. Dev.

Poison Control: Alert Level = 9

unintentional poisoning incidents reported
- Green: ≤ 2 Standard deviations
- Yellow: >2 and <3 Standard deviations
- Red: > 3 Standard deviations

Unexplained Deaths: Alert Level = 4
- Green: 0 - 3 unexplained deaths
- Yellow: 4 - 5 unexplained deaths
- Red: 6+ unexplained deaths

SFO Surveillance: Alert Level =
- Green: No alerts
- Yellow: Alerts not pursued
- Red: Public health intervention required

Maximum Temperature* Two-Day Forecast Redwood City Alert Level = Current = 65° F
- Green: ≤ 84° F — 10/13/2007 = 68° F
- Yellow: 85-94° F — 10/14/2007 = 70° F
- Red: ≥ 95° F

*Source: National Weather Service — Current Heat Index <80° F

Other: Disease Control and Prevention is currently investigating two unrelated respiratory outbreaks in assisted living facilities.

Alert Levels: LOW / MEDIUM / HIGH

Current Systems used in DSAT

The following surveillance systems are used in the DSAT. Seasonal systems such as Maximum Temperature and School Absenteeism are included when relevant. BioSense data for San Mateo County is monitored but currently not included in the daily report, due to on-going assessment.

- Emergency Department (ED) Census: ED Census measures daily ED volume of six hospitals for a 24 hour period.
- First Watch (www.First-Watch.us): First Watch uses real-time information from 911 calls and field data collection systems. It is a web-based system that allows the user to analyze data and to receive email alerts based on specified thresholds. Categories that are reported include: cardiac, breathing problems, chest pain, sick, unconscious, and bio (a cumulative of all five triggers).
- Real-time Outbreak and Disease Surveillance (RODS) (www.rods.pitt.edu): Measures unpromoted (non-advertised) and promoted (advertised) sales of over-the-counter (OTC) pharmaceuticals from 23 pharmacy locations within SMC. Categories that are monitored include: unpromoted OTC sales of anti-diarrheal medication, cough and cold medication, and thermometer sales.
- Poison Control: California Poison Control System collects data on both intentional and unintentional reported poisonings and sends a daily automated report. For the purposes of the DSAT, only data concerning unintentional poisonings are monitored for the purposes of detecting a covert terrorism event.
- Unexplained Deaths: The Coroner's Office sends daily reports to Vital Statistics on the number of deaths processed for a 24 hour period. A death is considered unexplained if the cause of death has not been found by either the attending physician or by the Coroner's Office at the time of the report (i.e. undetermined, pending investigation).
- San Francisco International Airport (SFO) Surveillance: The international terminal of SFO is monitored for disease by the Center for Disease Control and Prevention Quarantine Station (CDCPQS). The CDCPQS responds with quarantine measures if they suspect a passenger is ill with one of nine diseases of concern (i.e.. bioterrorism agents).
- Maximum Temperature Two-Day Forecast: Indicator for when cooling centers in SMC should be opened and special attention paid to those potentially at risk from heat stroke and other related conditions.
- National Bioterrorism Syndromic Surveillance Demonstration Project (NDP): designed as an evaluation tool to determine the positive predictive value, sensitivity, and timeliness of the surveillance system, as well as the costs and benefits of syndromic surveillance to public health. This uses Kaiser outpatient data and represents about 25% of the population.
- San Mateo County School Absenteeism: Data collected by 3rd party vendor will be reported through First Watch. Data will represent 20% of San Mateo County schools.
- BioSense: BioSense is an initiative to enhance early detection, quantification, and localization of possible bioterrorism attacks and naturally occurring events and help develop a real time national surveillance infrastructure. Data for San Mateo County comes from Department of Defense and Veterans Hospital, and LabCorp data.

Next Steps

The DSAT is a constantly evolving report designed to include the most relevant surveillance systems and data sources available to provide the best overall picture of health in San Mateo County. Seasonal surveillance systems such as Maximum Temperature and San Mateo County School Absenteeism are meant to be cycled in when relevant.

As more data is collected, better base line data and more precise thresholds for each of the surveillance systems can be generated. Systems with dynamic data and seasonal fluctuations, such as RODS and ED Census, provide challenges in analysis and interpretation. Ongoing assessment is necessary to provide an accurate summary of such data.

Future efforts may look at the relationships each system has with each of the other systems, in an effort to predicatively model the effects one system may have on another. Providing decision makers in the Health Department with more advance notice of potential outbreaks and other adverse health event will help to provide more effective public health response.