

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 6/8/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 6/8/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

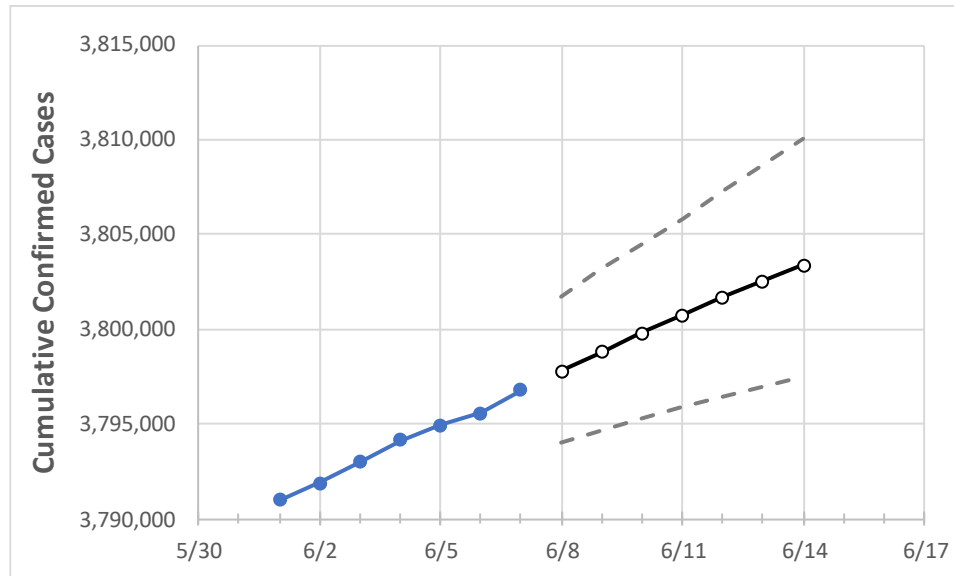
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

California State Projections



	Actual Confirmed Cases On:				Projected Cases For:							
	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	
California	3,794,129	3,794,927	3,795,580	3,796,776	3,797,815	3,798,811	3,799,799	3,800,756	3,801,680	3,802,534	3,803,388	

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

California Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14
Alameda	89,091	89,129	89,141	89,147	89,173	89,199	89,223	89,246	89,268	89,289	89,309
Contra Costa	69,827	69,886	69,945	70,003	70,042	70,080	70,118	70,156	70,195	70,231	70,268
Fresno	102,566	102,601	102,626	102,642	102,661	102,679	102,697	102,713	102,730	102,745	102,760
Kern	110,302	110,350	110,372	110,395	110,438	110,478	110,518	110,559	110,597	110,633	110,672
Lake	3,526	3,528	3,534	3,535	3,538	3,541	3,544	3,547	3,550	3,553	3,556
Los Angeles	1,244,684	1,244,917	1,245,120	1,245,254	1,245,416	1,245,577	1,245,737	1,245,897	1,246,057	1,246,213	1,246,368
Marin	14,151	14,153	14,156	14,157	14,161	14,165	14,168	14,172	14,176	14,180	14,183
Monterey	43,766	43,769	43,771	43,774	43,778	43,782	43,786	43,790	43,793	43,797	43,800
Orange	272,298	272,361	272,426	272,447	272,495	272,544	272,593	272,640	272,685	272,731	272,776
Placer	23,127	23,130	23,133	23,196	23,214	23,231	23,250	23,268	23,286	23,304	23,322
Riverside	300,929	300,957	300,985	301,013	301,042	301,071	301,101	301,128	301,155	301,180	301,205
Sacramento	106,714	106,796	106,879	106,961	107,029	107,098	107,167	107,233	107,298	107,360	107,424
San Bernardino	298,643	298,656	298,676	298,697	298,749	298,799	298,850	298,897	298,943	298,986	299,029
San Diego	280,555	280,675	280,742	280,807	280,879	280,951	281,024	281,095	281,165	281,235	281,306
San Francisco	37,072	37,079	37,111	37,118	37,132	37,145	37,160	37,173	37,187	37,200	37,214
San Joaquin	74,114	74,130	74,145	74,161	74,195	74,228	74,260	74,294	74,326	74,359	74,390
San Luis Obispo	21,363	21,365	21,367	21,369	21,374	21,379	21,384	21,389	21,394	21,399	21,404
San Mateo	42,396	42,413	42,433	42,457	42,470	42,482	42,494	42,505	42,517	42,528	42,538
Santa Barbara	34,526	34,531	34,536	34,541	34,546	34,550	34,555	34,559	34,563	34,567	34,571
Santa Clara	119,592	119,619	119,676	119,711	119,735	119,759	119,783	119,807	119,830	119,853	119,876
Santa Cruz	16,190	16,193	16,197	16,200	16,202	16,204	16,207	16,208	16,210	16,212	16,214
Solano	33,491	33,498	33,504	33,511	33,532	33,553	33,574	33,595	33,615	33,635	33,655
Sonoma	30,454	30,493	30,493	30,493	30,524	30,557	30,592	30,628	30,665	30,702	30,742
Ventura	81,457	81,474	81,490	81,507	81,521	81,534	81,548	81,561	81,573	81,586	81,598

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- **Beds:** For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report ([MMWR, March 18, 2020](#)) and state reports of COVID-19 cases.
- **ICU:** The CDC report found that 24% of hospitalized cases require ICU care.
- **Ventilators:** Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.

California Medical Demand by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	6/4	6/5	6/6	6/7	6/9				6/11				6/13			
Alameda	89,091	89,129	89,141	89,147	89,199	(17,840)	[4,282]	{2,141}	89,246	(17,849)	[4,284]	{2,142}	89,289	(17,858)	[4,286]	{2,143}
Contra Costa	69,827	69,886	69,945	70,003	70,080	(14,016)	[3,364]	{1,682}	70,156	(14,031)	[3,367]	{1,684}	70,231	(14,046)	[3,371]	{1,686}
Fresno	102,566	102,601	102,626	102,642	102,679	(20,536)	[4,929]	{2,464}	102,713	(20,543)	[4,930]	{2,465}	102,745	(20,549)	[4,932]	{2,466}
Kern	110,302	110,350	110,372	110,395	110,478	(22,096)	[5,303]	{2,651}	110,559	(22,112)	[5,307]	{2,653}	110,633	(22,127)	[5,310]	{2,655}
Lake	3,526	3,528	3,534	3,535	3,541	(708)	[170]	{85}	3,547	(709)	[170]	{85}	3,553	(711)	[171]	{85}
Los Angeles	1,244,684	1,244,917	1,245,120	1,245,254	1,245,577	(249,115)	[59,788]	{29,894}	1,245,897	(249,179)	[59,803]	{29,902}	1,246,213	(249,243)	[59,818]	{29,909}
Marin	14,151	14,153	14,156	14,157	14,165	(2,833)	[680]	{340}	14,172	(2,834)	[680]	{340}	14,180	(2,836)	[681]	{340}
Monterey	43,766	43,769	43,771	43,774	43,782	(8,756)	[2,102]	{1,051}	43,790	(8,758)	[2,102]	{1,051}	43,797	(8,759)	[2,102]	{1,051}
Orange	272,298	272,361	272,426	272,447	272,544	(54,509)	[13,082]	{6,541}	272,640	(54,528)	[13,087]	{6,543}	272,731	(54,546)	[13,091]	{6,546}
Placer	23,127	23,130	23,133	23,196	23,231	(4,646)	[1,115]	{558}	23,268	(4,654)	[1,117]	{558}	23,304	(4,661)	[1,119]	{559}
Riverside	300,929	300,957	300,985	301,013	301,071	(60,214)	[14,451]	{7,226}	301,128	(60,226)	[14,454]	{7,227}	301,180	(60,236)	[14,457]	{7,228}
Sacramento	106,714	106,796	106,879	106,961	107,098	(21,420)	[5,141]	{2,570}	107,233	(21,447)	[5,147]	{2,574}	107,360	(21,472)	[5,153]	{2,577}
San Bernardino	298,643	298,656	298,676	298,697	298,799	(59,760)	[14,342]	{7,171}	298,897	(59,779)	[14,347]	{7,174}	298,986	(59,797)	[14,351]	{7,176}
San Diego	280,555	280,675	280,742	280,807	280,951	(56,190)	[13,486]	{6,743}	281,095	(56,219)	[13,493]	{6,746}	281,235	(56,247)	[13,499]	{6,750}
San Francisco	37,072	37,079	37,111	37,118	37,145	(7,429)	[1,783]	{891}	37,173	(7,435)	[1,784]	{892}	37,200	(7,440)	[1,786]	{893}
San Joaquin	74,114	74,130	74,145	74,161	74,228	(14,846)	[3,563]	{1,781}	74,294	(14,859)	[3,566]	{1,783}	74,359	(14,872)	[3,569]	{1,785}
San Luis Obispo	21,363	21,365	21,367	21,369	21,379	(4,276)	[1,026]	{513}	21,389	(4,278)	[1,027]	{513}	21,399	(4,280)	[1,027]	{514}
San Mateo	42,396	42,413	42,433	42,457	42,482	(8,496)	[2,039]	{1,020}	42,505	(8,501)	[2,040]	{1,020}	42,528	(8,506)	[2,041]	{1,021}
Santa Barbara	34,526	34,531	34,536	34,541	34,550	(6,910)	[1,658]	{829}	34,559	(6,912)	[1,659]	{829}	34,567	(6,913)	[1,659]	{830}
Santa Clara	119,592	119,619	119,676	119,711	119,759	(23,952)	[5,748]	{2,874}	119,807	(23,961)	[5,751]	{2,875}	119,853	(23,971)	[5,753]	{2,876}
Santa Cruz	16,190	16,193	16,197	16,200	16,204	(3,241)	[778]	{389}	16,208	(3,242)	[778]	{389}	16,212	(3,242)	[778]	{389}
Solano	33,491	33,498	33,504	33,511	33,553	(6,711)	[1,611]	{805}	33,595	(6,719)	[1,613]	{806}	33,635	(6,727)	[1,615]	{807}
Sonoma	30,454	30,493	30,493	30,493	30,557	(6,111)	[1,467]	{733}	30,628	(6,126)	[1,470]	{735}	30,702	(6,140)	[1,474]	{737}
Ventura	81,457	81,474	81,490	81,507	81,534	(16,307)	[3,914]	{1,957}	81,561	(16,312)	[3,915]	{1,957}	81,586	(16,317)	[3,916]	{1,958}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.