

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

Date: 6/14/21

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 6/14/21 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.

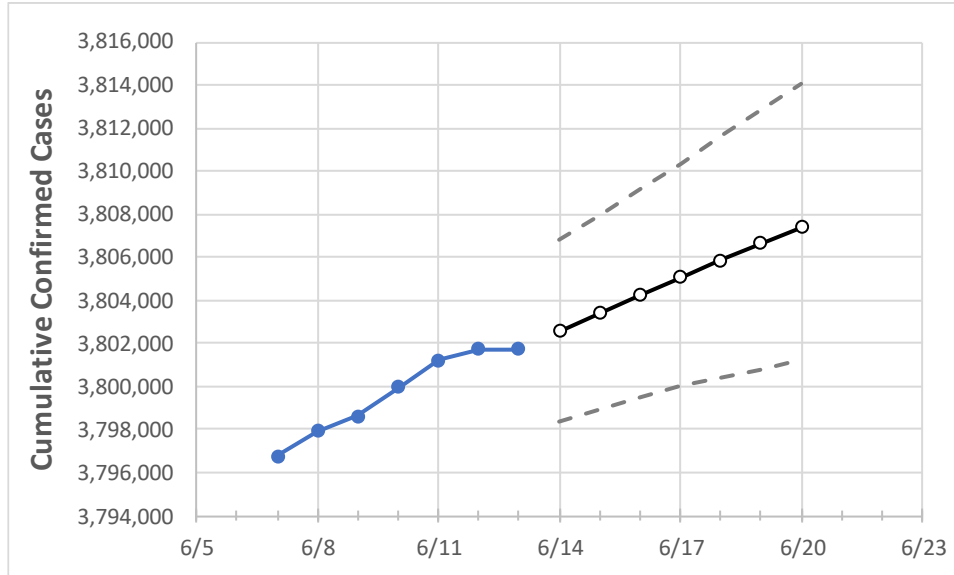
IEM's Modeling Lead

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:						
	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20

California 3,799,978 3,801,229 3,801,738 3,801,728 3,802,564 3,803,409 3,804,254 3,805,084 3,805,876 3,806,643 3,807,389

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:							
	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	
Alameda	89,304	89,339	89,340	89,340	89,366	89,392	89,416	89,441	89,465	89,489	89,512	
Contra Costa	70,168	70,228	70,276	70,276	70,329	70,383	70,437	70,493	70,549	70,607	70,665	
Fresno	102,690	102,724	102,770	102,783	102,801	102,819	102,836	102,853	102,869	102,885	102,901	
Kern	110,546	110,559	110,593	110,604	110,635	110,666	110,696	110,726	110,755	110,785	110,813	
Lake	3,541	3,550	3,551	3,552	3,555	3,558	3,561	3,564	3,567	3,570	3,573	
Los Angeles	1,245,786	1,245,949	1,246,123	1,246,129	1,246,273	1,246,415	1,246,550	1,246,688	1,246,817	1,246,949	1,247,083	
Marin	14,159	14,163	14,170	14,170	14,174	14,177	14,180	14,184	14,187	14,191	14,194	
Monterey	43,788	43,791	43,791	43,791	43,794	43,797	43,800	43,803	43,806	43,809	43,811	
Orange	272,617	272,650	272,650	272,650	272,694	272,739	272,784	272,829	272,873	272,916	272,959	
Placer	23,305	23,338	23,342	23,345	23,367	23,389	23,411	23,433	23,455	23,477	23,500	
Riverside	301,284	301,312	301,312	301,312	301,358	301,406	301,454	301,500	301,546	301,593	301,643	
Sacramento	107,117	107,186	107,193	107,199	107,246	107,292	107,337	107,380	107,421	107,464	107,503	
San Bernardino	298,843	298,898	298,939	298,976	299,011	299,044	299,075	299,108	299,139	299,170	299,201	
San Diego	281,051	281,143	281,202	281,203	281,266	281,328	281,389	281,451	281,511	281,568	281,625	
San Francisco	37,143	37,159	37,177	37,189	37,201	37,214	37,226	37,238	37,251	37,262	37,274	
San Joaquin	74,350	74,401	74,401	74,401	74,447	74,492	74,537	74,583	74,630	74,677	74,728	
San Luis Obispo	21,399	21,405	21,405	21,405	21,412	21,418	21,425	21,432	21,439	21,446	21,452	
San Mateo	42,502	42,562	42,585	42,604	42,629	42,654	42,681	42,709	42,738	42,768	42,799	
Santa Barbara	34,557	34,561	34,572	34,572	34,577	34,582	34,588	34,593	34,598	34,603	34,607	
Santa Clara	119,793	119,832	119,860	119,894	119,921	119,948	119,975	120,000	120,027	120,055	120,081	
Santa Cruz	16,198	16,202	16,202	16,202	16,204	16,207	16,209	16,212	16,214	16,216	16,219	
Solano	33,559	33,569	33,569	33,569	33,585	33,600	33,614	33,629	33,643	33,657	33,671	
Sonoma	30,616	30,659	30,688	30,688	30,723	30,759	30,795	30,832	30,872	30,913	30,955	
Ventura	81,546	81,554	81,554	81,554	81,567	81,580	81,593	81,605	81,617	81,629	81,641	

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:											
	6/10	6/11	6/12	6/13	6/15			6/17			6/19					
Alameda	89,304	89,339	89,340	89,340	89,392	(17,878)	[4,291]	{2,145}	89,441	(17,888)	[4,293]	{2,147}	89,489	(17,898)	[4,295]	{2,148}
Contra Costa	70,168	70,228	70,276	70,276	70,383	(14,077)	[3,378]	{1,689}	70,493	(14,099)	[3,384]	{1,692}	70,607	(14,121)	[3,389]	{1,695}
Fresno	102,690	102,724	102,770	102,783	102,819	(20,564)	[4,935]	{2,468}	102,853	(20,571)	[4,937]	{2,468}	102,885	(20,577)	[4,938]	{2,469}
Kern	110,546	110,559	110,593	110,604	110,666	(22,133)	[5,312]	{2,656}	110,726	(22,145)	[5,315]	{2,657}	110,785	(22,157)	[5,318]	{2,659}
Lake	3,541	3,550	3,551	3,552	3,558	(712)	[171]	{85}	3,564	(713)	[171]	{86}	3,570	(714)	[171]	{86}
Los Angeles	1,245,786	1,245,949	1,246,123	1,246,129	1,246,415	(249,283)	[59,828]	{29,914}	1,246,688	(249,338)	[59,841]	{29,921}	1,246,949	(249,390)	[59,854]	{29,927}
Marin	14,159	14,163	14,170	14,170	14,177	(2,835)	[680]	{340}	14,184	(2,837)	[681]	{340}	14,191	(2,838)	[681]	{341}
Monterey	43,788	43,791	43,791	43,791	43,797	(8,759)	[2,102]	{1,051}	43,803	(8,761)	[2,103]	{1,051}	43,809	(8,762)	[2,103]	{1,051}
Orange	272,617	272,650	272,650	272,650	272,739	(54,548)	[13,091]	{6,546}	272,829	(54,566)	[13,096]	{6,548}	272,916	(54,583)	[13,100]	{6,550}
Placer	23,305	23,338	23,342	23,345	23,389	(4,678)	[1,123]	{561}	23,433	(4,687)	[1,125]	{562}	23,477	(4,695)	[1,127]	{563}
Riverside	301,284	301,312	301,312	301,312	301,406	(60,281)	[14,467]	{7,234}	301,500	(60,300)	[14,472]	{7,236}	301,593	(60,319)	[14,476]	{7,238}
Sacramento	107,117	107,186	107,193	107,199	107,292	(21,458)	[5,150]	{2,575}	107,380	(21,476)	[5,154]	{2,577}	107,464	(21,493)	[5,158]	{2,579}
San Bernardino	298,843	298,898	298,939	298,976	299,044	(59,809)	[14,354]	{7,177}	299,108	(59,822)	[14,357]	{7,179}	299,170	(59,834)	[14,360]	{7,180}
San Diego	281,051	281,143	281,202	281,203	281,328	(56,266)	[13,504]	{6,752}	281,451	(56,290)	[13,510]	{6,755}	281,568	(56,314)	[13,515]	{6,758}
San Francisco	37,143	37,159	37,177	37,189	37,214	(7,443)	[1,786]	{893}	37,238	(7,448)	[1,787]	{894}	37,262	(7,452)	[1,789]	{894}
San Joaquin	74,350	74,401	74,401	74,401	74,492	(14,898)	[3,576]	{1,788}	74,583	(14,917)	[3,580]	{1,790}	74,677	(14,935)	[3,584]	{1,792}
San Luis Obispo	21,399	21,405	21,405	21,405	21,418	(4,284)	[1,028]	{514}	21,432	(4,286)	[1,029]	{514}	21,446	(4,289)	[1,029]	{515}
San Mateo	42,502	42,562	42,585	42,604	42,654	(8,531)	[2,047]	{1,024}	42,709	(8,542)	[2,050]	{1,025}	42,768	(8,554)	[2,053]	{1,026}
Santa Barbara	34,557	34,561	34,572	34,572	34,582	(6,916)	[1,660]	{830}	34,593	(6,919)	[1,660]	{830}	34,603	(6,921)	[1,661]	{830}
Santa Clara	119,793	119,832	119,860	119,894	119,948	(23,990)	[5,757]	{2,879}	120,000	(24,000)	[5,760]	{2,880}	120,055	(24,011)	[5,763]	{2,881}
Santa Cruz	16,198	16,202	16,202	16,202	16,207	(3,241)	[778]	{389}	16,212	(3,242)	[778]	{389}	16,216	(3,243)	[778]	{389}
Solano	33,559	33,569	33,569	33,569	33,600	(6,720)	[1,613]	{806}	33,629	(6,726)	[1,614]	{807}	33,657	(6,731)	[1,616]	{808}
Sonoma	30,616	30,659	30,688	30,688	30,759	(6,152)	[1,476]	{738}	30,832	(6,166)	[1,480]	{740}	30,913	(6,183)	[1,484]	{742}
Ventura	81,546	81,554	81,554	81,554	81,580	(16,316)	[3,916]	{1,958}	81,605	(16,321)	[3,917]	{1,959}	81,629	(16,326)	[3,918]	{1,959}

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.