

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 7/16/21**

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 7/16/21 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.

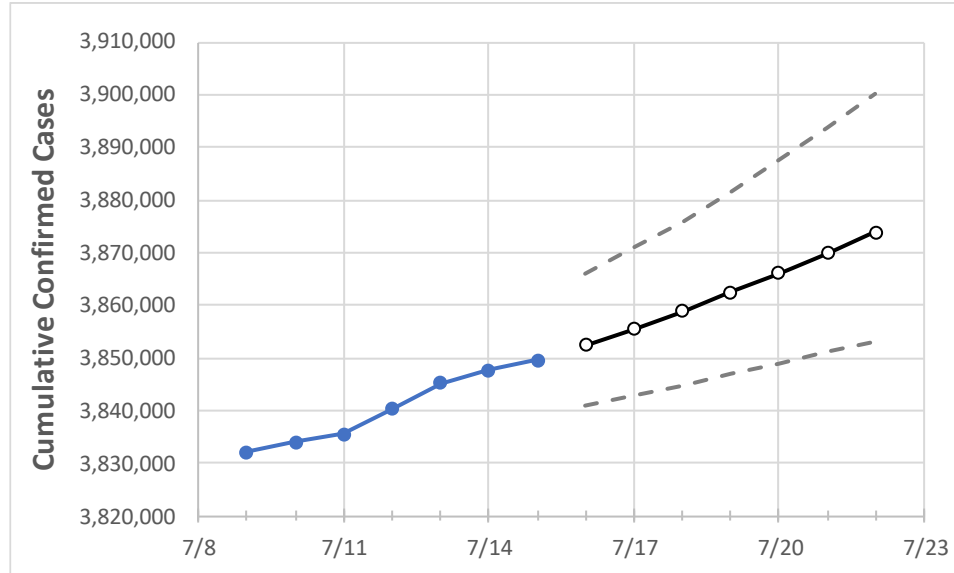
IEM's Modeling Lead

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:							
	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	
California	3,840,251	3,845,180	3,847,746	3,849,540	3,852,464	3,855,524	3,858,899	3,862,426	3,866,015	3,869,887	3,873,904	

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:						
	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22
Alameda	91,197	91,546	91,743	91,937	92,122	92,312	92,520	92,740	92,976	93,219	93,474
Contra Costa	72,218	72,326	72,384	72,442	72,535	72,633	72,735	72,838	72,943	73,051	73,163
Fresno	102,813	102,853	102,909	102,966	103,016	103,069	103,124	103,183	103,244	103,310	103,379
Kern	111,437	111,504	111,571	111,571	111,611	111,653	111,695	111,739	111,785	111,831	111,880
Lake	3,699	3,706	3,719	3,739	3,754	3,770	3,786	3,804	3,823	3,844	3,866
Los Angeles	1,258,685	1,259,992	1,261,068	1,261,164	1,262,285	1,263,460	1,264,725	1,266,051	1,267,458	1,268,982	1,270,585
Marin	14,350	14,374	14,383	14,392	14,406	14,421	14,437	14,454	14,472	14,491	14,510
Monterey	44,054	44,073	44,080	44,087	44,103	44,120	44,137	44,155	44,173	44,192	44,212
Orange	275,183	275,358	275,358	275,358	275,593	275,846	276,115	276,398	276,703	277,026	277,371
Placer	24,017	24,052	24,176	24,176	24,207	24,240	24,271	24,304	24,338	24,374	24,408
Riverside	302,495	302,353	302,211	302,069	302,554	303,097	303,692	304,338	305,050	305,856	306,712
Sacramento	110,264	110,435	110,639	110,781	110,983	111,193	111,411	111,638	111,876	112,117	112,379
San Bernardino	300,996	301,554	301,802	302,029	302,313	302,625	302,961	303,330	303,726	304,163	304,650
San Diego	284,647	284,996	284,997	285,697	285,985	286,288	286,614	286,967	287,341	287,740	288,144
San Francisco	37,596	37,656	37,725	37,836	37,935	38,043	38,161	38,288	38,429	38,581	38,747
San Joaquin	75,378	75,418	75,459	75,500	75,544	75,589	75,635	75,682	75,729	75,778	75,828
San Luis Obispo	21,578	21,588	21,588	21,588	21,599	21,610	21,622	21,635	21,648	21,661	21,675
San Mateo	43,107	43,138	43,180	43,249	43,303	43,357	43,416	43,476	43,538	43,602	43,665
Santa Barbara	34,793	34,808	34,829	34,849	34,866	34,884	34,904	34,924	34,946	34,968	34,993
Santa Clara	120,095	120,192	120,313	120,447	120,568	120,694	120,831	120,977	121,134	121,302	121,481
Santa Cruz	16,351	16,359	16,367	16,375	16,383	16,391	16,400	16,409	16,418	16,428	16,438
Solano	34,377	34,419	34,461	34,461	34,507	34,553	34,602	34,654	34,708	34,765	34,824
Sonoma	31,510	31,547	31,594	31,641	31,687	31,734	31,783	31,832	31,882	31,933	31,987
Ventura	82,080	82,120	82,160	82,160	82,187	82,215	82,245	82,276	82,308	82,341	82,376

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:											
	7/12	7/13	7/14	7/15	7/17				7/19				7/21			
Alameda	91,197	91,546	91,743	91,937	92,312	(18,462)	[4,431]	{2,215}	92,740	(18,548)	[4,452]	{2,226}	93,219	(18,644)	[4,475]	{2,237}
Contra Costa	72,218	72,326	72,384	72,442	72,633	(14,527)	[3,486]	{1,743}	72,838	(14,568)	[3,496]	{1,748}	73,051	(14,610)	[3,506]	{1,753}
Fresno	102,813	102,853	102,909	102,966	103,069	(20,614)	[4,947]	{2,474}	103,183	(20,637)	[4,953]	{2,476}	103,310	(20,662)	[4,959]	{2,479}
Kern	111,437	111,504	111,571	111,571	111,653	(22,331)	[5,359]	{2,680}	111,739	(22,348)	[5,363]	{2,682}	111,831	(22,366)	[5,368]	{2,684}
Lake	3,699	3,706	3,719	3,739	3,770	(754)	[181]	{90}	3,804	(761)	[183]	{91}	3,844	(769)	[185]	{92}
Los Angeles	1,258,685	1,259,992	1,261,068	1,261,164	1,263,460	(252,692)	[60,646]	{30,323}	1,266,051	(253,210)	[60,770]	{30,385}	1,268,982	(253,796)	[60,911]	{30,456}
Marin	14,350	14,374	14,383	14,392	14,421	(2,884)	[692]	{346}	14,454	(2,891)	[694]	{347}	14,491	(2,898)	[696]	{348}
Monterey	44,054	44,073	44,080	44,087	44,120	(8,824)	[2,118]	{1,059}	44,155	(8,831)	[2,119]	{1,060}	44,192	(8,838)	[2,121]	{1,061}
Orange	275,183	275,358	275,358	275,358	275,846	(55,169)	[13,241]	{6,620}	276,398	(55,280)	[13,267]	{6,634}	277,026	(55,405)	[13,297]	{6,649}
Placer	24,017	24,052	24,176	24,176	24,240	(4,848)	[1,164]	{582}	24,304	(4,861)	[1,167]	{583}	24,374	(4,875)	[1,170]	{585}
Riverside	302,495	302,353	302,211	302,069	303,097	(60,619)	[14,549]	{7,274}	304,338	(60,868)	[14,608]	{7,304}	305,856	(61,171)	[14,681]	{7,341}
Sacramento	110,264	110,435	110,639	110,781	111,193	(22,239)	[5,337]	{2,669}	111,638	(22,328)	[5,359]	{2,679}	112,117	(22,423)	[5,382]	{2,691}
San Bernardino	300,996	301,554	301,802	302,029	302,625	(60,525)	[14,526]	{7,263}	303,330	(60,666)	[14,560]	{7,280}	304,163	(60,833)	[14,600]	{7,300}
San Diego	284,647	284,996	284,997	285,697	286,288	(57,258)	[13,742]	{6,871}	286,967	(57,393)	[13,774]	{6,887}	287,740	(57,548)	[13,811]	{6,906}
San Francisco	37,596	37,656	37,725	37,836	38,043	(7,609)	[1,826]	{913}	38,288	(7,658)	[1,838]	{919}	38,581	(7,716)	[1,852]	{926}
San Joaquin	75,378	75,418	75,459	75,500	75,589	(15,118)	[3,628]	{1,814}	75,682	(15,136)	[3,633]	{1,816}	75,778	(15,156)	[3,637]	{1,819}
San Luis Obispo	21,578	21,588	21,588	21,588	21,610	(4,322)	[1,037]	{519}	21,635	(4,327)	[1,038]	{519}	21,661	(4,332)	[1,040]	{520}
San Mateo	43,107	43,138	43,180	43,249	43,357	(8,671)	[2,081]	{1,041}	43,476	(8,695)	[2,087]	{1,043}	43,602	(8,720)	[2,093]	{1,046}
Santa Barbara	34,793	34,808	34,829	34,849	34,884	(6,977)	[1,674]	{837}	34,924	(6,985)	[1,676]	{838}	34,968	(6,994)	[1,678]	{839}
Santa Clara	120,095	120,192	120,313	120,447	120,694	(24,139)	[5,793]	{2,897}	120,977	(24,195)	[5,807]	{2,903}	121,302	(24,260)	[5,822]	{2,911}
Santa Cruz	16,351	16,359	16,367	16,375	16,391	(3,278)	[787]	{393}	16,409	(3,282)	[788]	{394}	16,428	(3,286)	[789]	{394}
Solano	34,377	34,419	34,461	34,461	34,553	(6,911)	[1,659]	{829}	34,654	(6,931)	[1,663]	{832}	34,765	(6,953)	[1,669]	{834}
Sonoma	31,510	31,547	31,594	31,641	31,734	(6,347)	[1,523]	{762}	31,832	(6,366)	[1,528]	{764}	31,933	(6,387)	[1,533]	{766}
Ventura	82,080	82,120	82,160	82,160	82,215	(16,443)	[3,946]	{1,973}	82,276	(16,455)	[3,949]	{1,975}	82,341	(16,468)	[3,952]	{1,976}

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.