

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 5/20/21**

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 5/20/21 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.

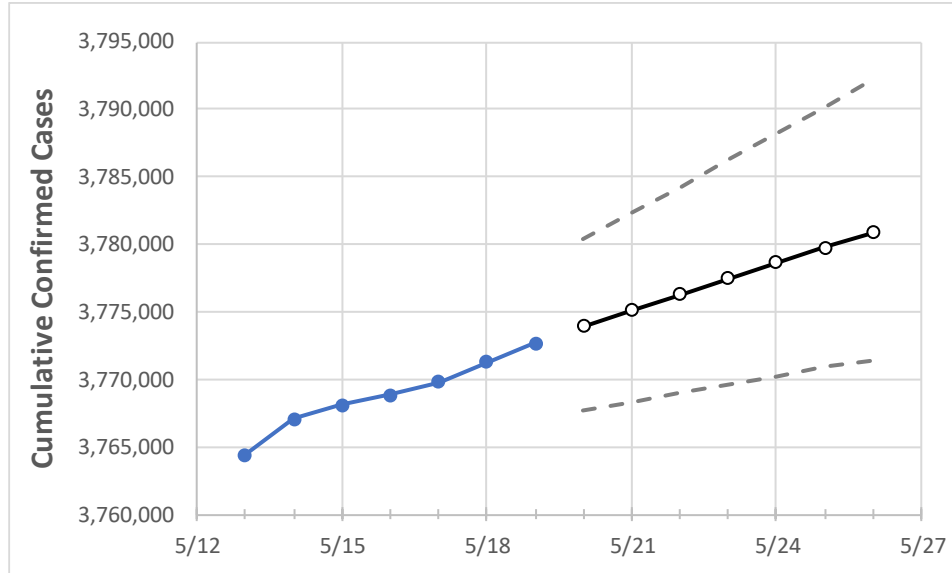
IEM's Modeling Lead

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:					
	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26
California	3,768,805	3,769,827	3,771,240	3,772,702	3,773,925	3,775,133	3,776,323	3,777,509	3,778,653	3,779,785	3,780,886

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:						
	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26
Alameda	88,148	88,157	88,207	88,306	88,361	88,415	88,468	88,521	88,575	88,630	88,682
Contra Costa	68,976	69,006	69,035	69,120	69,174	69,226	69,276	69,326	69,376	69,425	69,474
Fresno	101,957	101,987	102,013	102,056	102,093	102,131	102,168	102,204	102,241	102,277	102,312
Kern	109,298	109,320	109,351	109,424	109,462	109,497	109,532	109,567	109,602	109,634	109,668
Lake	3,485	3,489	3,492	3,495	3,498	3,500	3,503	3,506	3,509	3,511	3,514
Los Angeles	1,237,411	1,237,561	1,237,700	1,237,910	1,238,115	1,238,313	1,238,509	1,238,698	1,238,886	1,239,075	1,239,255
Marin	14,079	14,082	14,085	14,094	14,099	14,103	14,107	14,112	14,115	14,120	14,123
Monterey	43,663	43,664	43,664	43,674	43,683	43,691	43,700	43,708	43,716	43,724	43,731
Orange	271,251	271,296	271,352	271,421	271,479	271,536	271,592	271,648	271,702	271,756	271,809
Placer	22,688	22,720	22,745	22,801	22,820	22,839	22,856	22,873	22,890	22,904	22,920
Riverside	299,916	299,978	300,039	300,126	300,216	300,307	300,395	300,486	300,576	300,663	300,755
Sacramento	105,095	105,164	105,234	105,374	105,463	105,545	105,626	105,708	105,791	105,876	105,955
San Bernardino	297,213	297,261	297,300	297,349	297,425	297,502	297,578	297,653	297,727	297,803	297,880
San Diego	279,098	279,145	279,253	279,344	279,492	279,637	279,779	279,921	280,058	280,187	280,325
San Francisco	36,795	36,808	36,816	36,818	36,832	36,847	36,860	36,873	36,885	36,897	36,910
San Joaquin	73,356	73,378	73,401	73,440	73,470	73,498	73,526	73,551	73,575	73,598	73,620
San Luis Obispo	21,308	21,270	21,232	21,234	21,240	21,246	21,251	21,256	21,261	21,266	21,271
San Mateo	42,059	42,063	42,083	42,099	42,123	42,147	42,171	42,193	42,216	42,239	42,260
Santa Barbara	34,391	34,398	34,404	34,412	34,420	34,428	34,436	34,443	34,450	34,457	34,464
Santa Clara	119,060	119,098	119,116	119,171	119,206	119,240	119,274	119,307	119,338	119,369	119,397
Santa Cruz	16,272	16,275	16,275	16,275	16,286	16,296	16,305	16,314	16,322	16,330	16,338
Solano	32,999	33,011	33,026	33,086	33,110	33,134	33,157	33,179	33,199	33,220	33,239
Sonoma	30,067	30,071	30,101	30,104	30,115	30,125	30,135	30,145	30,155	30,165	30,174
Ventura	81,079	81,102	81,117	81,145	81,169	81,192	81,214	81,236	81,258	81,280	81,301

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:											
	5/16	5/17	5/18	5/19	5/21				5/23				5/25			
Alameda	88,148	88,157	88,207	88,306	88,415	(17,683)	[4,244]	{2,122}	88,521	(17,704)	[4,249]	{2,124}	88,630	(17,726)	[4,254]	{2,127}
Contra Costa	68,976	69,006	69,035	69,120	69,226	(13,845)	[3,323]	{1,661}	69,326	(13,865)	[3,328]	{1,664}	69,425	(13,885)	[3,332]	{1,666}
Fresno	101,957	101,987	102,013	102,056	102,131	(20,426)	[4,902]	{2,451}	102,204	(20,441)	[4,906]	{2,453}	102,277	(20,455)	[4,909]	{2,455}
Kern	109,298	109,320	109,351	109,424	109,497	(21,899)	[5,256]	{2,628}	109,567	(21,913)	[5,259]	{2,630}	109,634	(21,927)	[5,262]	{2,631}
Lake	3,485	3,489	3,492	3,495	3,500	(700)	[168]	{84}	3,506	(701)	[168]	{84}	3,511	(702)	[169]	{84}
Los Angeles	1,237,411	1,237,561	1,237,700	1,237,910	1,238,313	(247,663)	[59,439]	{29,720}	1,238,698	(247,740)	[59,458]	{29,729}	1,239,075	(247,815)	[59,476]	{29,738}
Marin	14,079	14,082	14,085	14,094	14,103	(2,821)	[677]	{338}	14,112	(2,822)	[677]	{339}	14,120	(2,824)	[678]	{339}
Monterey	43,663	43,664	43,664	43,674	43,691	(8,738)	[2,097]	{1,049}	43,708	(8,742)	[2,098]	{1,049}	43,724	(8,745)	[2,099]	{1,049}
Orange	271,251	271,296	271,352	271,421	271,536	(54,307)	[13,034]	{6,517}	271,648	(54,330)	[13,039]	{6,520}	271,756	(54,351)	[13,044]	{6,522}
Placer	22,688	22,720	22,745	22,801	22,839	(4,568)	[1,096]	{548}	22,873	(4,575)	[1,098]	{549}	22,904	(4,581)	[1,099]	{550}
Riverside	299,916	299,978	300,039	300,126	300,307	(60,061)	[14,415]	{7,207}	300,486	(60,097)	[14,423]	{7,212}	300,663	(60,133)	[14,432]	{7,216}
Sacramento	105,095	105,164	105,234	105,374	105,545	(21,109)	[5,066]	{2,533}	105,708	(21,142)	[5,074]	{2,537}	105,876	(21,175)	[5,082]	{2,541}
San Bernardino	297,213	297,261	297,300	297,349	297,502	(59,500)	[14,280]	{7,140}	297,653	(59,531)	[14,287]	{7,144}	297,803	(59,561)	[14,295]	{7,147}
San Diego	279,098	279,145	279,253	279,344	279,637	(55,927)	[13,423]	{6,711}	279,921	(55,984)	[13,436]	{6,718}	280,187	(56,037)	[13,449]	{6,724}
San Francisco	36,795	36,808	36,816	36,818	36,847	(7,369)	[1,769]	{884}	36,873	(7,375)	[1,770]	{885}	36,897	(7,379)	[1,771]	{886}
San Joaquin	73,356	73,378	73,401	73,440	73,498	(14,700)	[3,528]	{1,764}	73,551	(14,710)	[3,530]	{1,765}	73,598	(14,720)	[3,533]	{1,766}
San Luis Obispo	21,308	21,270	21,232	21,234	21,246	(4,249)	[1,020]	{510}	21,256	(4,251)	[1,020]	{510}	21,266	(4,253)	[1,021]	{510}
San Mateo	42,059	42,063	42,083	42,099	42,147	(8,429)	[2,023]	{1,012}	42,193	(8,439)	[2,025]	{1,013}	42,239	(8,448)	[2,027]	{1,014}
Santa Barbara	34,391	34,398	34,404	34,412	34,428	(6,886)	[1,653]	{826}	34,443	(6,889)	[1,653]	{827}	34,457	(6,891)	[1,654]	{827}
Santa Clara	119,060	119,098	119,116	119,171	119,240	(23,848)	[5,724]	{2,862}	119,307	(23,861)	[5,727]	{2,863}	119,369	(23,874)	[5,730]	{2,865}
Santa Cruz	16,272	16,275	16,275	16,275	16,296	(3,259)	[782]	{391}	16,314	(3,263)	[783]	{392}	16,330	(3,266)	[784]	{392}
Solano	32,999	33,011	33,026	33,086	33,134	(6,627)	[1,590]	{795}	33,179	(6,636)	[1,593]	{796}	33,220	(6,644)	[1,595]	{797}
Sonoma	30,067	30,071	30,101	30,104	30,125	(6,025)	[1,446]	{723}	30,145	(6,029)	[1,447]	{723}	30,165	(6,033)	[1,448]	{724}
Ventura	81,079	81,102	81,117	81,145	81,192	(16,238)	[3,897]	{1,949}	81,236	(16,247)	[3,899]	{1,950}	81,280	(16,256)	[3,901]	{1,951}

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.