

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

Date: 6/29/21

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 6/29/21 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.

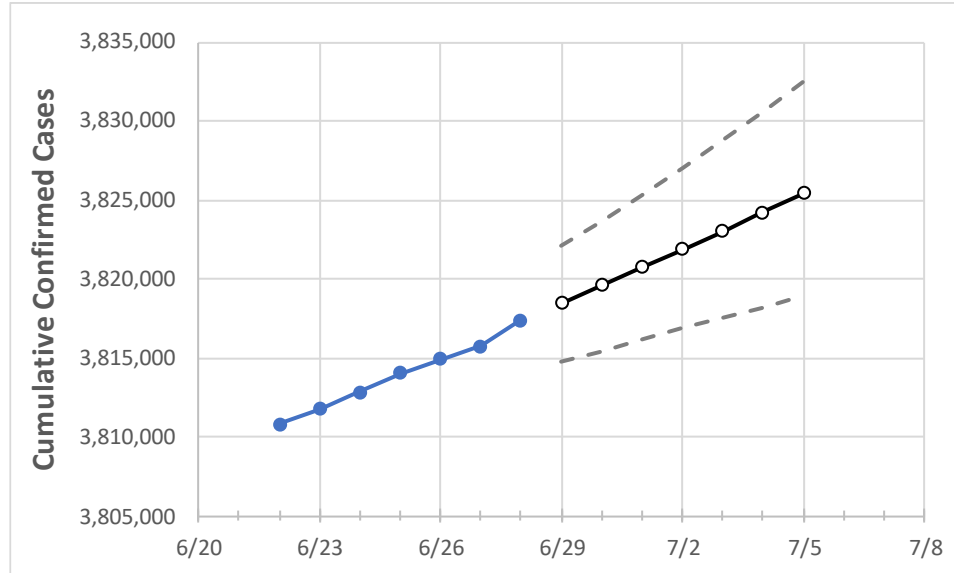
IEM's Modeling Lead

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:						
	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5
California	3,814,010	3,814,890	3,815,751	3,817,372	3,818,475	3,819,590	3,820,723	3,821,858	3,823,036	3,824,220	3,825,448

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:						
	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5
Alameda	89,937	90,090	90,103	90,165	90,234	90,300	90,372	90,448	90,524	90,602	90,686
Contra Costa	70,914	70,945	71,048	71,093	71,150	71,209	71,270	71,327	71,386	71,447	71,506
Fresno	103,061	103,073	103,091	103,110	103,134	103,158	103,182	103,206	103,230	103,255	103,279
Kern	110,948	110,982	111,015	111,049	111,081	111,113	111,146	111,180	111,213	111,246	111,280
Lake	3,571	3,574	3,576	3,581	3,583	3,584	3,586	3,588	3,589	3,591	3,593
Los Angeles	1,248,737	1,249,065	1,249,304	1,249,572	1,249,850	1,250,134	1,250,431	1,250,736	1,251,044	1,251,364	1,251,697
Marin	14,215	14,218	14,224	14,227	14,230	14,233	14,236	14,239	14,242	14,246	14,249
Monterey	43,859	43,860	43,868	43,875	43,879	43,884	43,888	43,893	43,898	43,902	43,907
Orange	273,225	273,292	273,360	273,427	273,485	273,543	273,603	273,666	273,729	273,794	273,861
Placer	23,673	23,688	23,702	23,751	23,777	23,804	23,830	23,857	23,884	23,911	23,939
Riverside	301,799	301,799	301,799	301,799	301,820	301,839	301,857	301,875	301,893	301,910	301,925
Sacramento	108,085	108,132	108,179	108,411	108,506	108,606	108,709	108,816	108,928	109,043	109,161
San Bernardino	299,480	299,502	299,604	299,672	299,721	299,773	299,824	299,876	299,930	299,982	300,037
San Diego	282,156	282,262	282,358	282,416	282,502	282,590	282,677	282,768	282,859	282,953	283,047
San Francisco	37,320	37,338	37,348	37,360	37,372	37,385	37,398	37,411	37,424	37,437	37,450
San Joaquin	74,808	74,808	74,808	74,808	74,825	74,843	74,859	74,877	74,892	74,906	74,923
San Luis Obispo	21,448	21,448	21,448	21,448	21,450	21,451	21,452	21,453	21,455	21,456	21,457
San Mateo	42,814	42,849	42,898	42,925	42,961	42,999	43,037	43,079	43,124	43,169	43,217
Santa Barbara	34,637	34,642	34,651	34,659	34,666	34,672	34,679	34,686	34,693	34,700	34,707
Santa Clara	120,274	120,272	120,321	120,352	120,385	120,418	120,453	120,486	120,522	120,556	120,591
Santa Cruz	16,264	16,266	16,267	16,269	16,272	16,276	16,279	16,282	16,286	16,289	16,293
Solano	33,846	33,863	33,881	33,898	33,919	33,941	33,964	33,986	34,009	34,032	34,056
Sonoma	31,059	31,103	31,116	31,129	31,157	31,185	31,211	31,239	31,266	31,294	31,321
Ventura	81,750	81,759	81,767	81,776	81,790	81,805	81,819	81,834	81,849	81,863	81,877

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:											
	6/25	6/26	6/27	6/28	6/30				7/2				7/4			
Alameda	89,937	90,090	90,103	90,165	90,300	(18,060)	[4,334]	{2,167}	90,448	(18,090)	[4,341]	{2,171}	90,602	(18,120)	[4,349]	{2,174}
Contra Costa	70,914	70,945	71,048	71,093	71,209	(14,242)	[3,418]	{1,709}	71,327	(14,265)	[3,424]	{1,712}	71,447	(14,289)	[3,429]	{1,715}
Fresno	103,061	103,073	103,091	103,110	103,158	(20,632)	[4,952]	{2,476}	103,206	(20,641)	[4,954]	{2,477}	103,255	(20,651)	[4,956]	{2,478}
Kern	110,948	110,982	111,015	111,049	111,113	(22,223)	[5,333]	{2,667}	111,180	(22,236)	[5,337]	{2,668}	111,246	(22,249)	[5,340]	{2,670}
Lake	3,571	3,574	3,576	3,581	3,584	(717)	[172]	{86}	3,588	(718)	[172]	{86}	3,591	(718)	[172]	{86}
Los Angeles	1,248,737	1,249,065	1,249,304	1,249,572	1,250,134	(250,027)	[60,006]	{30,003}	1,250,736	(250,147)	[60,035]	{30,018}	1,251,364	(250,273)	[60,065]	{30,033}
Marin	14,215	14,218	14,224	14,227	14,233	(2,847)	[683]	{342}	14,239	(2,848)	[683]	{342}	14,246	(2,849)	[684]	{342}
Monterey	43,859	43,860	43,868	43,875	43,884	(8,777)	[2,106]	{1,053}	43,893	(8,779)	[2,107]	{1,053}	43,902	(8,780)	[2,107]	{1,054}
Orange	273,225	273,292	273,360	273,427	273,543	(54,709)	[13,130]	{6,565}	273,666	(54,733)	[13,136]	{6,568}	273,794	(54,759)	[13,142]	{6,571}
Placer	23,673	23,688	23,702	23,751	23,804	(4,761)	[1,143]	{571}	23,857	(4,771)	[1,145]	{573}	23,911	(4,782)	[1,148]	{574}
Riverside	301,799	301,799	301,799	301,799	301,839	(60,368)	[14,488]	{7,244}	301,875	(60,375)	[14,490]	{7,245}	301,910	(60,382)	[14,492]	{7,246}
Sacramento	108,085	108,132	108,179	108,411	108,606	(21,721)	[5,213]	{2,607}	108,816	(21,763)	[5,223]	{2,612}	109,043	(21,809)	[5,234]	{2,617}
San Bernardino	299,480	299,502	299,604	299,672	299,773	(59,955)	[14,389]	{7,195}	299,876	(59,975)	[14,394]	{7,197}	299,982	(59,996)	[14,399]	{7,200}
San Diego	282,156	282,262	282,358	282,416	282,590	(56,518)	[13,564]	{6,782}	282,768	(56,554)	[13,573]	{6,786}	282,953	(56,591)	[13,582]	{6,791}
San Francisco	37,320	37,338	37,348	37,360	37,385	(7,477)	[1,794]	{897}	37,411	(7,482)	[1,796]	{898}	37,437	(7,487)	[1,797]	{898}
San Joaquin	74,808	74,808	74,808	74,808	74,843	(14,969)	[3,592]	{1,796}	74,877	(14,975)	[3,594]	{1,797}	74,906	(14,981)	[3,595]	{1,798}
San Luis Obispo	21,448	21,448	21,448	21,448	21,451	(4,290)	[1,030]	{515}	21,453	(4,291)	[1,030]	{515}	21,456	(4,291)	[1,030]	{515}
San Mateo	42,814	42,849	42,898	42,925	42,999	(8,600)	[2,064]	{1,032}	43,079	(8,616)	[2,068]	{1,034}	43,169	(8,634)	[2,072]	{1,036}
Santa Barbara	34,637	34,642	34,651	34,659	34,672	(6,934)	[1,664]	{832}	34,686	(6,937)	[1,665]	{832}	34,700	(6,940)	[1,666]	{833}
Santa Clara	120,274	120,272	120,321	120,352	120,418	(24,084)	[5,780]	{2,890}	120,486	(24,097)	[5,783]	{2,892}	120,556	(24,111)	[5,787]	{2,893}
Santa Cruz	16,264	16,266	16,267	16,269	16,276	(3,255)	[781]	{391}	16,282	(3,256)	[782]	{391}	16,289	(3,258)	[782]	{391}
Solano	33,846	33,863	33,881	33,898	33,941	(6,788)	[1,629]	{815}	33,986	(6,797)	[1,631]	{816}	34,032	(6,806)	[1,634]	{817}
Sonoma	31,059	31,103	31,116	31,129	31,185	(6,237)	[1,497]	{748}	31,239	(6,248)	[1,499]	{750}	31,294	(6,259)	[1,502]	{751}
Ventura	81,750	81,759	81,767	81,776	81,805	(16,361)	[3,927]	{1,963}	81,834	(16,367)	[3,928]	{1,964}	81,863	(16,373)	[3,929]	{1,965}

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.