

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

Date: 6/1/21

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 6/1/21 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.

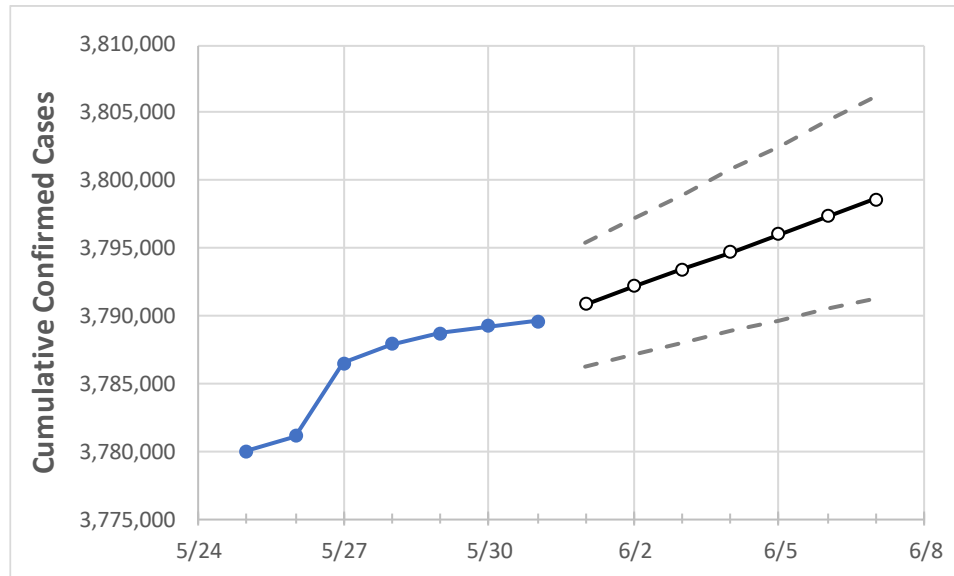
IEM's Modeling Lead

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:							
	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	
California	3,787,911	3,788,713	3,789,227	3,789,572	3,790,859	3,792,164	3,793,440	3,794,727	3,796,045	3,797,351	3,798,626	

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:						
	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7
Alameda	88,837	88,893	88,922	88,929	88,975	89,022	89,064	89,108	89,149	89,190	89,228
Contra Costa	69,574	69,635	69,663	69,676	69,715	69,751	69,787	69,824	69,858	69,892	69,926
Fresno	102,413	102,437	102,470	102,499	102,531	102,565	102,597	102,629	102,661	102,693	102,723
Kern	109,999	110,089	110,111	110,131	110,191	110,249	110,310	110,370	110,431	110,493	110,555
Lake	3,509	3,515	3,516	3,517	3,519	3,520	3,522	3,523	3,524	3,526	3,527
Los Angeles	1,243,531	1,243,712	1,243,882	1,244,054	1,244,215	1,244,371	1,244,521	1,244,671	1,244,814	1,244,957	1,245,099
Marin	14,122	14,137	14,143	14,144	14,148	14,152	14,156	14,160	14,164	14,168	14,172
Monterey	43,730	43,739	43,739	43,739	43,745	43,752	43,758	43,764	43,770	43,776	43,782
Orange	271,936	272,059	272,094	272,094	272,151	272,207	272,263	272,320	272,378	272,435	272,492
Placer	23,004	23,007	23,009	23,016	23,030	23,044	23,058	23,071	23,084	23,097	23,108
Riverside	300,701	300,701	300,701	300,701	300,758	300,815	300,872	300,929	300,983	301,038	301,094
Sacramento	106,265	106,265	106,265	106,265	106,355	106,444	106,532	106,625	106,714	106,802	106,892
San Bernardino	298,289	298,289	298,289	298,289	298,405	298,527	298,655	298,789	298,924	299,053	299,187
San Diego	280,042	280,150	280,208	280,253	280,302	280,348	280,395	280,436	280,477	280,516	280,552
San Francisco	36,980	36,987	37,008	37,016	37,029	37,041	37,053	37,065	37,077	37,088	37,100
San Joaquin	73,794	73,794	73,794	73,794	73,831	73,868	73,905	73,942	73,979	74,015	74,051
San Luis Obispo	21,315	21,315	21,315	21,315	21,323	21,330	21,338	21,345	21,352	21,360	21,367
San Mateo	42,345	42,364	42,375	42,386	42,404	42,421	42,437	42,454	42,471	42,487	42,503
Santa Barbara	34,488	34,488	34,488	34,488	34,494	34,500	34,507	34,513	34,518	34,524	34,529
Santa Clara	119,452	119,462	119,498	119,510	119,531	119,552	119,571	119,590	119,608	119,626	119,644
Santa Cruz	16,169	16,169	16,169	16,169	16,171	16,173	16,175	16,177	16,179	16,180	16,182
Solano	33,293	33,293	33,293	33,293	33,313	33,334	33,354	33,373	33,394	33,413	33,433
Sonoma	30,298	30,333	30,336	30,336	30,359	30,383	30,407	30,431	30,457	30,484	30,511
Ventura	81,344	81,344	81,344	81,344	81,362	81,380	81,398	81,415	81,433	81,450	81,466

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:											
	5/28	5/29	5/30	5/31	6/2				6/4				6/6			
Alameda	88,837	88,893	88,922	88,929	89,022	(17,804)	[4,273]	{2,137}	89,108	(17,822)	[4,277]	{2,139}	89,190	(17,838)	[4,281]	{2,141}
Contra Costa	69,574	69,635	69,663	69,676	69,751	(13,950)	[3,348]	{1,674}	69,824	(13,965)	[3,352]	{1,676}	69,892	(13,978)	[3,355]	{1,677}
Fresno	102,413	102,437	102,470	102,499	102,565	(20,513)	[4,923]	{2,462}	102,629	(20,526)	[4,926]	{2,463}	102,693	(20,539)	[4,929]	{2,465}
Kern	109,999	110,089	110,111	110,131	110,249	(22,050)	[5,292]	{2,646}	110,370	(22,074)	[5,298]	{2,649}	110,493	(22,099)	[5,304]	{2,652}
Lake	3,509	3,515	3,516	3,517	3,520	(704)	[169]	{84}	3,523	(705)	[169]	{85}	3,526	(705)	[169]	{85}
Los Angeles	1,243,531	1,243,712	1,243,882	1,244,054	1,244,371	(248,874)	[59,730]	{29,865}	1,244,671	(248,934)	[59,744]	{29,872}	1,244,957	(248,991)	[59,758]	{29,879}
Marin	14,122	14,137	14,143	14,144	14,152	(2,830)	[679]	{340}	14,160	(2,832)	[680]	{340}	14,168	(2,834)	[680]	{340}
Monterey	43,730	43,739	43,739	43,739	43,752	(8,750)	[2,100]	{1,050}	43,764	(8,753)	[2,101]	{1,050}	43,776	(8,755)	[2,101]	{1,051}
Orange	271,936	272,059	272,094	272,094	272,207	(54,441)	[13,066]	{6,533}	272,320	(54,464)	[13,071]	{6,536}	272,435	(54,487)	[13,077]	{6,538}
Placer	23,004	23,007	23,009	23,016	23,044	(4,609)	[1,106]	{553}	23,071	(4,614)	[1,107]	{554}	23,097	(4,619)	[1,109]	{554}
Riverside	300,701	300,701	300,701	300,701	300,815	(60,163)	[14,439]	{7,220}	300,929	(60,186)	[14,445]	{7,222}	301,038	(60,208)	[14,450]	{7,225}
Sacramento	106,265	106,265	106,265	106,265	106,444	(21,289)	[5,109]	{2,555}	106,625	(21,325)	[5,118]	{2,559}	106,802	(21,360)	[5,126]	{2,563}
San Bernardino	298,289	298,289	298,289	298,289	298,527	(59,705)	[14,329]	{7,165}	298,789	(59,758)	[14,342]	{7,171}	299,053	(59,811)	[14,355]	{7,177}
San Diego	280,042	280,150	280,208	280,253	280,348	(56,070)	[13,457]	{6,728}	280,436	(56,087)	[13,461]	{6,730}	280,516	(56,103)	[13,465]	{6,732}
San Francisco	36,980	36,987	37,008	37,016	37,041	(7,408)	[1,778]	{889}	37,065	(7,413)	[1,779]	{890}	37,088	(7,418)	[1,780]	{890}
San Joaquin	73,794	73,794	73,794	73,794	73,868	(14,774)	[3,546]	{1,773}	73,942	(14,788)	[3,549]	{1,775}	74,015	(14,803)	[3,553]	{1,776}
San Luis Obispo	21,315	21,315	21,315	21,315	21,330	(4,266)	[1,024]	{512}	21,345	(4,269)	[1,025]	{512}	21,360	(4,272)	[1,025]	{513}
San Mateo	42,345	42,364	42,375	42,386	42,421	(8,484)	[2,036]	{1,018}	42,454	(8,491)	[2,038]	{1,019}	42,487	(8,497)	[2,039]	{1,020}
Santa Barbara	34,488	34,488	34,488	34,488	34,500	(6,900)	[1,656]	{828}	34,513	(6,903)	[1,657]	{828}	34,524	(6,905)	[1,657]	{829}
Santa Clara	119,452	119,462	119,498	119,510	119,552	(23,910)	[5,738]	{2,869}	119,590	(23,918)	[5,740]	{2,870}	119,626	(23,925)	[5,742]	{2,871}
Santa Cruz	16,169	16,169	16,169	16,169	16,173	(3,235)	[776]	{388}	16,177	(3,235)	[776]	{388}	16,180	(3,236)	[777]	{388}
Solano	33,293	33,293	33,293	33,293	33,334	(6,667)	[1,600]	{800}	33,373	(6,675)	[1,602]	{801}	33,413	(6,683)	[1,604]	{802}
Sonoma	30,298	30,333	30,336	30,336	30,383	(6,077)	[1,458]	{729}	30,431	(6,086)	[1,461]	{730}	30,484	(6,097)	[1,463]	{732}
Ventura	81,344	81,344	81,344	81,344	81,380	(16,276)	[3,906]	{1,953}	81,415	(16,283)	[3,908]	{1,954}	81,450	(16,290)	[3,910]	{1,955}

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.