

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 2/18/22**

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 2/18/22 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.

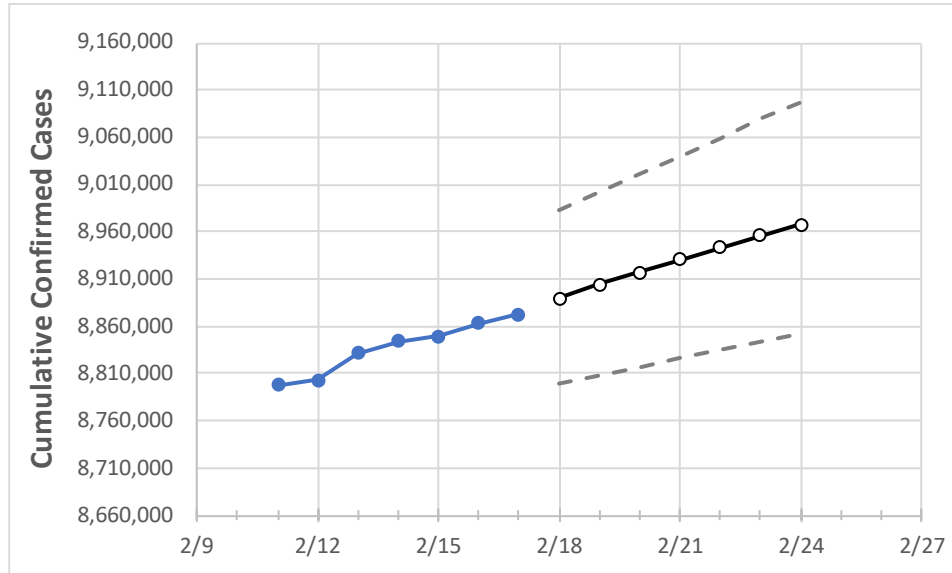
IEM's Modeling Lead

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
California	8,844,213	8,849,745	8,863,723	8,873,200	8,889,786	8,904,253	8,917,469	8,930,430	8,943,083	8,955,730	8,967,763

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
Alameda	259,141	259,143	260,093	258,903	259,460	260,062	260,588	261,072	261,523	262,025	262,540
Contra Costa	194,809	194,811	195,099	194,936	195,322	195,625	195,968	196,274	196,623	196,927	197,189
Fresno	242,956	242,960	243,273	244,263	244,883	245,402	245,940	246,506	246,932	247,508	247,956
Kern	228,153	229,034	229,772	230,630	231,273	231,937	232,516	233,140	233,727	234,323	234,856
Lake	10,833	10,844	10,855	10,998	11,058	11,120	11,182	11,244	11,306	11,361	11,421
Los Angeles	2,764,073	2,766,161	2,769,372	2,772,569	2,775,808	2,778,840	2,781,882	2,784,637	2,787,262	2,789,715	2,791,854
Marin	35,740	35,766	35,791	34,500	34,562	34,624	34,686	34,739	34,795	34,852	34,906
Monterey	88,323	88,328	88,451	89,259	89,890	90,461	90,993	91,493	92,108	92,558	93,109
Orange	576,253	577,043	577,597	578,359	579,142	579,935	580,510	581,135	581,772	582,375	582,982
Placer	68,296	68,297	68,344	68,369	68,477	68,594	68,688	68,806	68,902	69,006	69,112
Riverside	606,346	606,348	607,114	607,861	608,754	609,596	610,513	611,283	612,188	613,029	613,757
Sacramento	295,025	295,029	295,432	295,488	296,052	296,556	297,047	297,532	297,999	298,462	298,877
San Bernardino	575,213	575,225	575,690	575,784	576,464	577,109	577,729	578,324	578,923	579,548	580,055
San Diego	770,562	772,354	774,146	776,192	777,572	778,904	780,161	781,378	782,558	783,835	784,862
San Francisco	129,317	129,318	129,496	129,568	130,061	130,517	130,975	131,315	131,777	132,273	132,763
San Joaquin	171,789	171,791	171,946	171,592	171,855	172,188	172,432	172,693	172,963	173,227	173,463
San Luis Obispo	54,299	54,300	54,369	54,295	54,431	54,546	54,677	54,800	54,907	55,039	55,147
San Mateo	123,585	123,647	123,709	123,267	124,163	124,748	125,426	125,999	126,763	127,514	128,209
Santa Barbara	88,230	88,249	88,267	88,612	88,820	88,988	89,183	89,350	89,523	89,706	89,853
Santa Clara	314,104	314,107	314,619	314,480	315,284	316,024	316,735	317,369	318,026	318,744	319,302
Santa Cruz	47,083	47,148	47,212	47,094	47,258	47,418	47,554	47,712	47,843	48,009	48,138
Solano	83,752	83,776	83,869	83,933	84,244	84,534	84,896	85,150	85,473	85,871	86,109
Sonoma	82,486	82,487	82,584	82,541	82,719	82,893	83,055	83,222	83,371	83,537	83,681
Ventura	178,998	178,999	179,216	179,182	179,428	179,685	179,893	180,107	180,314	180,578	180,777

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:											
	2/14	2/15	2/16	2/17	2/19				2/21				2/23			
Alameda	259,141	259,143	260,093	258,903	260,062	(52,012)	[12,483]	{6,241}	261,072	(52,214)	[12,531]	{6,266}	262,025	(52,405)	[12,577]	{6,289}
Contra Costa	194,809	194,811	195,099	194,936	195,625	(39,125)	[9,390]	{4,695}	196,274	(39,255)	[9,421]	{4,711}	196,927	(39,385)	[9,452]	{4,726}
Fresno	242,956	242,960	243,273	244,263	245,402	(49,080)	[11,779]	{5,890}	246,506	(49,301)	[11,832]	{5,916}	247,508	(49,502)	[11,880]	{5,940}
Kern	228,153	229,034	229,772	230,630	231,937	(46,387)	[11,133]	{5,566}	233,140	(46,628)	[11,191]	{5,595}	234,323	(46,865)	[11,247]	{5,624}
Lake	10,833	10,844	10,855	10,998	11,120	(2,224)	[534]	{267}	11,244	(2,249)	[540]	{270}	11,361	(2,272)	[545]	{273}
Los Angeles	2,764,073	2,766,161	2,769,372	2,772,569	2,778,840	(555,768)	[133,384]	{66,692}	2,784,637	(556,927)	[133,663]	{66,831}	2,789,715	(557,943)	[133,906]	{66,953}
Marin	35,740	35,766	35,791	34,500	34,624	(6,925)	[1,662]	{831}	34,739	(6,948)	[1,667]	{834}	34,852	(6,970)	[1,673]	{836}
Monterey	88,323	88,328	88,451	89,259	90,461	(18,092)	[4,342]	{2,171}	91,493	(18,299)	[4,392]	{2,196}	92,558	(18,512)	[4,443]	{2,221}
Orange	576,253	577,043	577,597	578,359	579,935	(115,987)	[27,837]	{13,918}	581,135	(116,227)	[27,894]	{13,947}	582,375	(116,475)	[27,954]	{13,977}
Placer	68,296	68,297	68,344	68,369	68,594	(13,719)	[3,293]	{1,646}	68,806	(13,761)	[3,303]	{1,651}	69,006	(13,801)	[3,312]	{1,656}
Riverside	606,346	606,348	607,114	607,861	609,596	(121,919)	[29,261]	{14,630}	611,283	(122,257)	[29,342]	{14,671}	613,029	(122,606)	[29,425]	{14,713}
Sacramento	295,025	295,029	295,432	295,488	296,556	(59,311)	[14,235]	{7,117}	297,532	(59,506)	[14,282]	{7,141}	298,462	(59,692)	[14,326]	{7,163}
San Bernardino	575,213	575,225	575,690	575,784	577,109	(115,422)	[27,701]	{13,851}	578,324	(115,665)	[27,760]	{13,880}	579,548	(115,910)	[27,818]	{13,909}
San Diego	770,562	772,354	774,146	776,192	778,904	(155,781)	[37,387]	{18,694}	781,378	(156,276)	[37,506]	{18,753}	783,835	(156,767)	[37,624]	{18,812}
San Francisco	129,317	129,318	129,496	129,568	130,517	(26,103)	[6,265]	{3,132}	131,315	(26,263)	[6,303]	{3,152}	132,273	(26,455)	[6,349]	{3,175}
San Joaquin	171,789	171,791	171,946	171,592	172,188	(34,438)	[8,265]	{4,133}	172,693	(34,539)	[8,289]	{4,145}	173,227	(34,645)	[8,315]	{4,157}
San Luis Obispo	54,299	54,300	54,369	54,295	54,546	(10,909)	[2,618]	{1,309}	54,800	(10,960)	[2,630]	{1,315}	55,039	(11,008)	[2,642]	{1,321}
San Mateo	123,585	123,647	123,709	123,267	124,748	(24,950)	[5,988]	{2,994}	125,999	(25,200)	[6,048]	{3,024}	127,514	(25,503)	[6,121]	{3,060}
Santa Barbara	88,230	88,249	88,267	88,612	88,988	(17,798)	[4,271]	{2,136}	89,350	(17,870)	[4,289]	{2,144}	89,706	(17,941)	[4,306]	{2,153}
Santa Clara	314,104	314,107	314,619	314,480	316,024	(63,205)	[15,169]	{7,585}	317,369	(63,474)	[15,234]	{7,617}	318,744	(63,749)	[15,300]	{7,650}
Santa Cruz	47,083	47,148	47,212	47,094	47,418	(9,484)	[2,276]	{1,138}	47,712	(9,542)	[2,290]	{1,145}	48,009	(9,602)	[2,304]	{1,152}
Solano	83,752	83,776	83,869	83,933	84,534	(16,907)	[4,058]	{2,029}	85,150	(17,030)	[4,087]	{2,044}	85,871	(17,174)	[4,122]	{2,061}
Sonoma	82,486	82,487	82,584	82,541	82,893	(16,579)	[3,979]	{1,989}	83,222	(16,644)	[3,995]	{1,997}	83,537	(16,707)	[4,010]	{2,005}
Ventura	178,998	178,999	179,216	179,182	179,685	(35,937)	[8,625]	{4,312}	180,107	(36,021)	[8,645]	{4,323}	180,578	(36,116)	[8,668]	{4,334}

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.