

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

Date: 2/8/21

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 2/8/21 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.

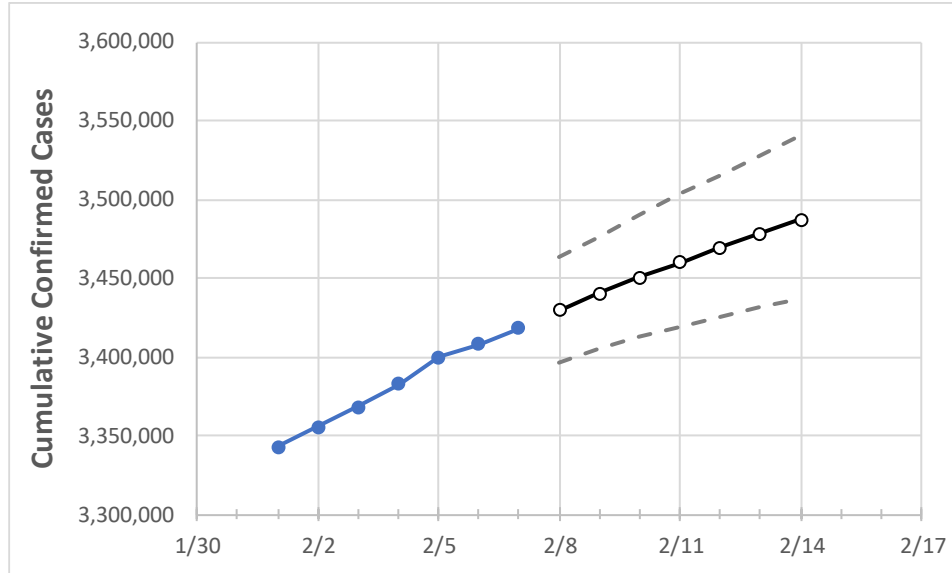
IEM's Modeling Lead

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:							
	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	
California	3,382,932	3,399,745	3,408,241	3,417,982	3,429,378	3,440,048	3,450,340	3,460,123	3,469,471	3,478,580	3,486,890	

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:						
	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14
Alameda	75,175	78,224	75,737	76,170	76,977	77,801	78,656	79,515	80,385	81,287	82,228
Contra Costa	58,248	58,462	58,839	59,107	59,336	59,562	59,788	59,996	60,200	60,396	60,584
Fresno	89,748	90,126	90,513	90,944	91,240	91,523	91,800	92,061	92,310	92,568	92,806
Kern	95,993	96,514	96,862	97,249	97,670	98,072	98,456	98,831	99,190	99,532	99,865
Lake	2,869	2,882	2,906	2,920	2,932	2,943	2,955	2,966	2,976	2,986	2,995
Los Angeles	1,134,595	1,138,970	1,143,591	1,146,483	1,149,927	1,153,248	1,156,449	1,159,445	1,162,350	1,165,165	1,167,681
Marin	12,520	12,559	12,603	12,625	12,661	12,696	12,731	12,764	12,795	12,825	12,855
Monterey	40,237	40,463	40,532	40,532	40,686	40,834	40,975	41,112	41,245	41,376	41,498
Orange	249,195	250,300	251,079	252,311	253,254	254,198	255,130	256,039	256,964	257,918	258,794
Placer	18,738	18,784	18,810	18,836	18,880	18,924	18,963	18,999	19,038	19,073	19,104
Riverside	279,189	280,170	280,170	280,170	281,076	281,925	282,756	283,539	284,314	284,980	285,626
Sacramento	87,415	87,704	87,992	88,532	88,768	88,996	89,209	89,408	89,601	89,779	89,941
San Bernardino	276,606	277,430	277,949	277,949	278,453	278,965	279,431	279,823	280,192	280,542	280,858
San Diego	242,616	244,069	245,334	246,564	247,659	248,686	249,727	250,710	251,689	252,607	253,509
San Francisco	31,983	32,116	32,229	32,437	32,556	32,671	32,782	32,889	32,996	33,099	33,200
San Joaquin	63,258	63,619	63,619	63,619	63,897	64,163	64,415	64,661	64,912	65,158	65,407
San Luis Obispo	18,353	18,467	18,467	18,467	18,575	18,680	18,781	18,878	18,972	19,065	19,154
San Mateo	36,451	36,599	36,689	36,824	36,963	37,098	37,224	37,343	37,458	37,566	37,671
Santa Barbara	29,431	29,564	29,755	29,941	30,105	30,265	30,412	30,554	30,701	30,840	30,977
Santa Clara	103,748	104,076	104,609	105,094	105,444	105,789	106,123	106,428	106,736	107,033	107,315
Santa Cruz	13,790	13,853	13,915	13,915	13,971	14,028	14,082	14,132	14,183	14,233	14,279
Solano	28,511	28,686	28,686	28,686	28,797	28,906	29,014	29,115	29,214	29,313	29,406
Sonoma	26,430	26,595	26,674	26,836	26,933	27,026	27,116	27,202	27,283	27,368	27,448
Ventura	72,124	72,595	72,953	73,431	73,839	74,242	74,628	74,996	75,350	75,691	76,018

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:											
	2/4	2/5	2/6	2/7	2/9				2/11				2/13			
Alameda	75,175	78,224	75,737	76,170	77,801	(15,560)	[3,734]	{1,867}	79,515	(15,903)	[3,817]	{1,908}	81,287	(16,257)	[3,902]	{1,951}
Contra Costa	58,248	58,462	58,839	59,107	59,562	(11,912)	[2,859]	{1,429}	59,996	(11,999)	[2,880]	{1,440}	60,396	(12,079)	[2,899]	{1,450}
Fresno	89,748	90,126	90,513	90,944	91,523	(18,305)	[4,393]	{2,197}	92,061	(18,412)	[4,419]	{2,209}	92,568	(18,514)	[4,443]	{2,222}
Kern	95,993	96,514	96,862	97,249	98,072	(19,614)	[4,707]	{2,354}	98,831	(19,766)	[4,744]	{2,372}	99,532	(19,906)	[4,778]	{2,389}
Lake	2,869	2,882	2,906	2,920	2,943	(589)	[141]	{71}	2,966	(593)	[142]	{71}	2,986	(597)	[143]	{72}
Los Angeles	1,134,595	1,138,970	1,143,591	1,146,483	1,153,248	(230,650)	[55,356]	{27,678}	1,159,445	(231,889)	[55,653]	{27,827}	1,165,165	(233,033)	[55,928]	{27,964}
Marin	12,520	12,559	12,603	12,625	12,696	(2,539)	[609]	{305}	12,764	(2,553)	[613]	{306}	12,825	(2,565)	[616]	{308}
Monterey	40,237	40,463	40,532	40,532	40,834	(8,167)	[1,960]	{980}	41,112	(8,222)	[1,973]	{987}	41,376	(8,275)	[1,986]	{993}
Orange	249,195	250,300	251,079	252,311	254,198	(50,840)	[12,201]	{6,101}	256,039	(51,208)	[12,290]	{6,145}	257,918	(51,584)	[12,380]	{6,190}
Placer	18,738	18,784	18,810	18,836	18,924	(3,785)	[908]	{454}	18,999	(3,800)	[912]	{456}	19,073	(3,815)	[915]	{458}
Riverside	279,189	280,170	280,170	280,170	281,925	(56,385)	[13,532]	{6,766}	283,539	(56,708)	[13,610]	{6,805}	284,980	(56,996)	[13,679]	{6,840}
Sacramento	87,415	87,704	87,992	88,532	88,996	(17,799)	[4,272]	{2,136}	89,408	(17,882)	[4,292]	{2,146}	89,779	(17,956)	[4,309]	{2,155}
San Bernardino	276,606	277,430	277,949	277,949	278,965	(55,793)	[13,390]	{6,695}	279,823	(55,965)	[13,432]	{6,716}	280,542	(56,108)	[13,466]	{6,733}
San Diego	242,616	244,069	245,334	246,564	248,686	(49,737)	[11,937]	{5,968}	250,710	(50,142)	[12,034]	{6,017}	252,607	(50,521)	[12,125]	{6,063}
San Francisco	31,983	32,116	32,229	32,437	32,671	(6,534)	[1,568]	{784}	32,889	(6,578)	[1,579]	{789}	33,099	(6,620)	[1,589]	{794}
San Joaquin	63,258	63,619	63,619	63,619	64,163	(12,833)	[3,080]	{1,540}	64,661	(12,932)	[3,104]	{1,552}	65,158	(13,032)	[3,128]	{1,564}
San Luis Obispo	18,353	18,467	18,467	18,467	18,680	(3,736)	[897]	{448}	18,878	(3,776)	[906]	{453}	19,065	(3,813)	[915]	{458}
San Mateo	36,451	36,599	36,689	36,824	37,098	(7,420)	[1,781]	{890}	37,343	(7,469)	[1,792]	{896}	37,566	(7,513)	[1,803]	{902}
Santa Barbara	29,431	29,564	29,755	29,941	30,265	(6,053)	[1,453]	{726}	30,554	(6,111)	[1,467]	{733}	30,840	(6,168)	[1,480]	{740}
Santa Clara	103,748	104,076	104,609	105,094	105,789	(21,158)	[5,078]	{2,539}	106,428	(21,286)	[5,109]	{2,554}	107,033	(21,407)	[5,138]	{2,569}
Santa Cruz	13,790	13,853	13,915	13,915	14,028	(2,806)	[673]	{337}	14,132	(2,826)	[678]	{339}	14,233	(2,847)	[683]	{342}
Solano	28,511	28,686	28,686	28,686	28,906	(5,781)	[1,387]	{694}	29,115	(5,823)	[1,398]	{699}	29,313	(5,863)	[1,407]	{704}
Sonoma	26,430	26,595	26,674	26,836	27,026	(5,405)	[1,297]	{649}	27,202	(5,440)	[1,306]	{653}	27,368	(5,474)	[1,314]	{657}
Ventura	72,124	72,595	72,953	73,431	74,242	(14,848)	[3,564]	{1,782}	74,996	(14,999)	[3,600]	{1,800}	75,691	(15,138)	[3,633]	{1,817}

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.