

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

Date: 2/3/21

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 2/3/21 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.

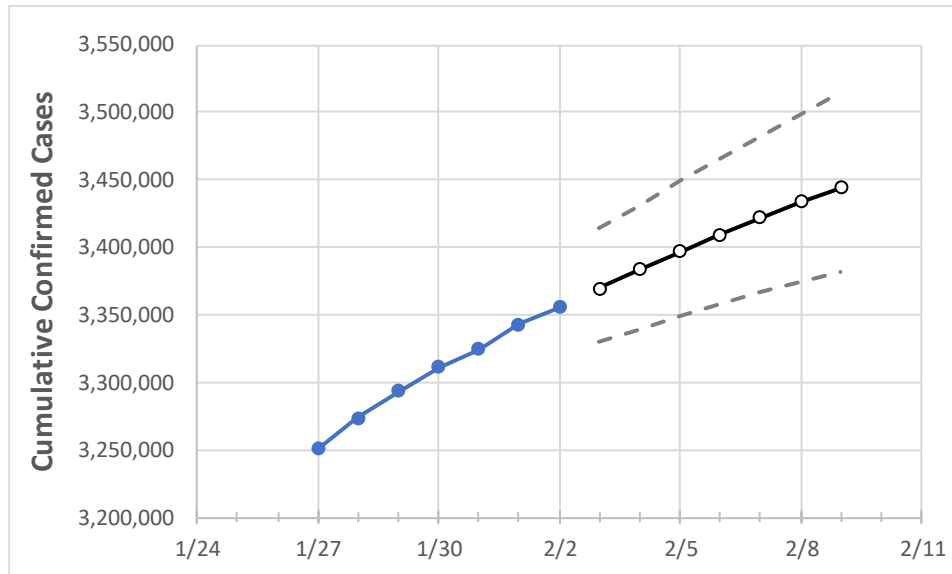
IEM's Modeling Lead

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:							
	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	
California	3,310,949	3,324,264	3,342,647	3,355,781	3,369,924	3,383,680	3,396,921	3,409,655	3,421,801	3,433,580	3,444,347	

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:						
	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9
Alameda	73,542	73,771	74,087	74,661	75,037	75,405	75,749	76,090	76,409	76,729	77,040
Contra Costa	57,021	57,337	57,580	57,812	58,074	58,329	58,576	58,818	59,056	59,271	59,486
Fresno	87,936	88,476	88,852	89,272	89,640	89,992	90,330	90,653	90,962	91,273	91,568
Kern	93,628	94,113	94,467	94,994	95,460	95,917	96,357	96,771	97,184	97,570	97,964
Lake	2,792	2,809	2,826	2,843	2,857	2,869	2,882	2,894	2,906	2,916	2,927
Los Angeles	1,111,391	1,116,948	1,121,107	1,124,975	1,129,623	1,134,034	1,138,196	1,142,252	1,146,182	1,149,850	1,153,313
Marin	12,284	12,346	12,372	12,408	12,445	12,480	12,513	12,545	12,578	12,609	12,639
Monterey	39,425	39,605	39,786	39,966	40,201	40,424	40,651	40,875	41,094	41,311	41,511
Orange	244,562	245,978	247,035	247,886	248,584	249,219	249,854	250,435	251,015	251,555	252,054
Placer	18,415	18,430	18,608	18,638	18,702	18,763	18,821	18,877	18,930	18,981	19,030
Riverside	273,231	274,551	275,872	276,931	278,502	280,020	281,495	283,138	284,578	286,033	287,448
Sacramento	86,320	86,388	86,560	86,856	87,151	87,449	87,723	87,994	88,250	88,486	88,716
San Bernardino	273,520	274,429	275,076	275,372	276,334	277,238	278,052	278,890	279,665	280,435	281,136
San Diego	236,768	238,042	239,142	240,050	241,290	242,463	243,593	244,629	245,648	246,634	247,629
San Francisco	31,294	31,427	31,563	31,703	31,831	31,953	32,070	32,186	32,295	32,403	32,508
San Joaquin	61,983	62,064	62,146	62,737	62,980	63,221	63,448	63,666	63,866	64,067	64,267
San Luis Obispo	17,699	17,793	17,887	18,038	18,152	18,264	18,370	18,470	18,570	18,670	18,761
San Mateo	35,466	35,674	35,882	36,052	36,238	36,417	36,592	36,760	36,921	37,078	37,222
Santa Barbara	28,338	28,567	28,830	29,009	29,218	29,418	29,620	29,808	30,000	30,184	30,363
Santa Clara	101,453	101,964	102,427	102,836	103,245	103,643	104,019	104,383	104,740	105,065	105,378
Santa Cruz	13,352	13,383	13,606	13,648	13,719	13,783	13,846	13,907	13,970	14,029	14,089
Solano	27,868	28,029	28,191	28,290	28,428	28,565	28,700	28,830	28,956	29,081	29,196
Sonoma	25,992	26,108	26,189	26,250	26,372	26,491	26,598	26,711	26,819	26,915	27,012
Ventura	69,511	69,931	70,799	71,212	71,708	72,180	72,631	73,086	73,499	73,909	74,312

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:											
	1/30	1/31	2/1	2/2	2/4				2/6				2/8			
Alameda	73,542	73,771	74,087	74,661	75,405	(15,081)	[3,619]	{1,810}	76,090	(15,218)	[3,652]	{1,826}	76,729	(15,346)	[3,683]	{1,841}
Contra Costa	57,021	57,337	57,580	57,812	58,329	(11,666)	[2,800]	{1,400}	58,818	(11,764)	[2,823]	{1,412}	59,271	(11,854)	[2,845]	{1,422}
Fresno	87,936	88,476	88,852	89,272	89,992	(17,998)	[4,320]	{2,160}	90,653	(18,131)	[4,351]	{2,176}	91,273	(18,255)	[4,381]	{2,191}
Kern	93,628	94,113	94,467	94,994	95,917	(19,183)	[4,604]	{2,302}	96,771	(19,354)	[4,645]	{2,322}	97,570	(19,514)	[4,683]	{2,342}
Lake	2,792	2,809	2,826	2,843	2,869	(574)	[138]	{69}	2,894	(579)	[139]	{69}	2,916	(583)	[140]	{70}
Los Angeles	1,111,391	1,116,948	1,121,107	1,124,975	1,134,034	(226,807)	[54,434]	{27,217}	1,142,252	(228,450)	[54,828]	{27,414}	1,149,850	(229,970)	[55,193]	{27,596}
Marin	12,284	12,346	12,372	12,408	12,480	(2,496)	[599]	{300}	12,545	(2,509)	[602]	{301}	12,609	(2,522)	[605]	{303}
Monterey	39,425	39,605	39,786	39,966	40,424	(8,085)	[1,940]	{970}	40,875	(8,175)	[1,962]	{981}	41,311	(8,262)	[1,983]	{991}
Orange	244,562	245,978	247,035	247,886	249,219	(49,844)	[11,963]	{5,981}	250,435	(50,087)	[12,021]	{6,010}	251,555	(50,311)	[12,075]	{6,037}
Placer	18,415	18,430	18,608	18,638	18,763	(3,753)	[901]	{450}	18,877	(3,775)	[906]	{453}	18,981	(3,796)	[911]	{456}
Riverside	273,231	274,551	275,872	276,931	280,020	(56,004)	[13,441]	{6,720}	283,138	(56,628)	[13,591]	{6,795}	286,033	(57,207)	[13,730]	{6,865}
Sacramento	86,320	86,388	86,560	86,856	87,449	(17,490)	[4,198]	{2,099}	87,994	(17,599)	[4,224]	{2,112}	88,486	(17,697)	[4,247]	{2,124}
San Bernardino	273,520	274,429	275,076	275,372	277,238	(55,448)	[13,307]	{6,654}	278,890	(55,778)	[13,387]	{6,693}	280,435	(56,087)	[13,461]	{6,730}
San Diego	236,768	238,042	239,142	240,050	242,463	(48,493)	[11,638]	{5,819}	244,629	(48,926)	[11,742]	{5,871}	246,634	(49,327)	[11,838]	{5,919}
San Francisco	31,294	31,427	31,563	31,703	31,953	(6,391)	[1,534]	{767}	32,186	(6,437)	[1,545]	{772}	32,403	(6,481)	[1,555]	{778}
San Joaquin	61,983	62,064	62,146	62,737	63,221	(12,644)	[3,035]	{1,517}	63,666	(12,733)	[3,056]	{1,528}	64,067	(12,813)	[3,075]	{1,538}
San Luis Obispo	17,699	17,793	17,887	18,038	18,264	(3,653)	[877]	{438}	18,470	(3,694)	[887]	{443}	18,670	(3,734)	[896]	{448}
San Mateo	35,466	35,674	35,882	36,052	36,417	(7,283)	[1,748]	{874}	36,760	(7,352)	[1,764]	{882}	37,078	(7,416)	[1,780]	{890}
Santa Barbara	28,338	28,567	28,830	29,009	29,418	(5,884)	[1,412]	{706}	29,808	(5,962)	[1,431]	{715}	30,184	(6,037)	[1,449]	{724}
Santa Clara	101,453	101,964	102,427	102,836	103,643	(20,729)	[4,975]	{2,487}	104,383	(20,877)	[5,010]	{2,505}	105,065	(21,013)	[5,043]	{2,522}
Santa Cruz	13,352	13,383	13,606	13,648	13,783	(2,757)	[662]	{331}	13,907	(2,781)	[668]	{334}	14,029	(2,806)	[673]	{337}
Solano	27,868	28,029	28,191	28,290	28,565	(5,713)	[1,371]	{686}	28,830	(5,766)	[1,384]	{692}	29,081	(5,816)	[1,396]	{698}
Sonoma	25,992	26,108	26,189	26,250	26,491	(5,298)	[1,272]	{636}	26,711	(5,342)	[1,282]	{641}	26,915	(5,383)	[1,292]	{646}
Ventura	69,511	69,931	70,799	71,212	72,180	(14,436)	[3,465]	{1,732}	73,086	(14,617)	[3,508]	{1,754}	73,909	(14,782)	[3,548]	{1,774}

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.