

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

Date: 9/29/21

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 9/29/21 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.

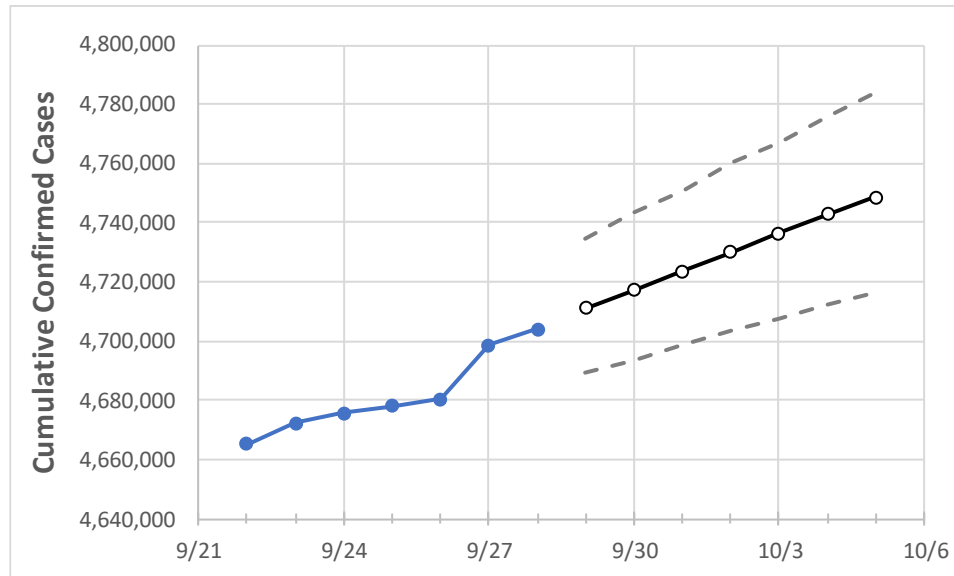
IEM's Modeling Lead

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:						
	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5
California	4,678,038	4,680,552	4,698,504	4,704,036	4,710,991	4,717,095	4,723,529	4,729,902	4,736,282	4,742,797	4,748,674

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:						
	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5
Alameda	117,094	117,240	117,387	117,517	117,650	117,784	117,911	118,037	118,155	118,277	118,390
Contra Costa	96,601	96,736	96,871	96,973	97,090	97,203	97,315	97,422	97,525	97,629	97,730
Fresno	137,855	138,089	138,323	138,563	138,825	139,082	139,336	139,586	139,819	140,071	140,304
Kern	137,249	137,567	137,884	138,233	138,601	138,965	139,325	139,679	140,034	140,374	140,716
Lake	6,169	6,185	6,202	6,215	6,231	6,247	6,263	6,277	6,292	6,306	6,320
Los Angeles	1,452,998	1,454,172	1,455,155	1,456,275	1,457,610	1,458,933	1,460,250	1,461,507	1,462,748	1,464,027	1,465,240
Marin	17,229	17,244	17,258	17,259	17,277	17,295	17,312	17,330	17,346	17,363	17,379
Monterey	49,733	49,733	49,872	49,891	49,930	49,964	50,000	50,034	50,070	50,104	50,137
Orange	316,813	317,406	317,998	318,305	318,751	319,190	319,641	320,082	320,528	320,977	321,431
Placer	37,033	37,033	37,312	37,356	37,435	37,516	37,592	37,667	37,742	37,814	37,880
Riverside	360,057	360,058	361,852	362,124	362,562	362,943	363,400	363,818	364,233	364,651	365,038
Sacramento	151,659	151,659	152,676	153,027	153,298	153,527	153,749	153,995	154,198	154,444	154,651
San Bernardino	349,044	349,047	350,405	350,586	350,940	351,296	351,667	351,999	352,341	352,683	353,007
San Diego	353,904	354,391	354,732	355,346	355,954	356,580	357,165	357,766	358,338	358,955	359,523
San Francisco	52,454	52,517	52,580	52,645	52,722	52,798	52,872	52,943	53,016	53,090	53,155
San Joaquin	98,682	98,848	99,013	99,163	99,344	99,529	99,705	99,880	100,048	100,218	100,382
San Luis Obispo	28,671	28,715	28,759	28,809	28,861	28,911	28,959	29,007	29,053	29,098	29,145
San Mateo	52,655	52,713	52,770	52,826	52,883	52,937	52,991	53,043	53,094	53,144	53,191
Santa Barbara	43,353	43,353	43,571	43,637	43,710	43,782	43,840	43,910	43,973	44,043	44,104
Santa Clara	141,165	141,166	141,810	141,945	142,099	142,238	142,373	142,525	142,642	142,803	142,924
Santa Cruz	20,295	20,314	20,334	20,347	20,367	20,385	20,402	20,420	20,437	20,454	20,470
Solano	44,444	44,452	44,658	44,703	44,763	44,815	44,871	44,921	44,975	45,025	45,070
Sonoma	39,704	39,752	39,799	39,844	39,886	39,928	39,968	40,006	40,046	40,084	40,119
Ventura	98,291	98,292	98,624	98,710	98,815	98,911	99,002	99,103	99,181	99,279	99,365

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:											
	9/25	9/26	9/27	9/28	9/30				10/2				10/4			
Alameda	117,094	117,240	117,387	117,517	117,784	(23,557)	[5,654]	{2,827}	118,037	(23,607)	[5,666]	{2,833}	118,277	(23,655)	[5,677]	{2,839}
Contra Costa	96,601	96,736	96,871	96,973	97,203	(19,441)	[4,666]	{2,333}	97,422	(19,484)	[4,676]	{2,338}	97,629	(19,526)	[4,686]	{2,343}
Fresno	137,855	138,089	138,323	138,563	139,082	(27,816)	[6,676]	{3,338}	139,586	(27,917)	[6,700]	{3,350}	140,071	(28,014)	[6,723]	{3,362}
Kern	137,249	137,567	137,884	138,233	138,965	(27,793)	[6,670]	{3,335}	139,679	(27,936)	[6,705]	{3,352}	140,374	(28,075)	[6,738]	{3,369}
Lake	6,169	6,185	6,202	6,215	6,247	(1,249)	[300]	{150}	6,277	(1,255)	[301]	{151}	6,306	(1,261)	[303]	{151}
Los Angeles	1,452,998	1,454,172	1,455,155	1,456,275	1,458,933	(291,787)	[70,029]	{35,014}	1,461,507	(292,301)	[70,152]	{35,076}	1,464,027	(292,805)	[70,273]	{35,137}
Marin	17,229	17,244	17,258	17,259	17,295	(3,459)	[830]	{415}	17,330	(3,466)	[832]	{416}	17,363	(3,473)	[833]	{417}
Monterey	49,733	49,733	49,872	49,891	49,964	(9,993)	[2,398]	{1,199}	50,034	(10,007)	[2,402]	{1,201}	50,104	(10,021)	[2,405]	{1,202}
Orange	316,813	317,406	317,998	318,305	319,190	(63,838)	[15,321]	{7,661}	320,082	(64,016)	[15,364]	{7,682}	320,977	(64,195)	[15,407]	{7,703}
Placer	37,033	37,033	37,312	37,356	37,516	(7,503)	[1,801]	{900}	37,667	(7,533)	[1,808]	{904}	37,814	(7,563)	[1,815]	{908}
Riverside	360,057	360,058	361,852	362,124	362,943	(72,589)	[17,421]	{8,711}	363,818	(72,764)	[17,463]	{8,732}	364,651	(72,930)	[17,503]	{8,752}
Sacramento	151,659	151,659	152,676	153,027	153,527	(30,705)	[7,369]	{3,685}	153,995	(30,799)	[7,392]	{3,696}	154,444	(30,889)	[7,413]	{3,707}
San Bernardino	349,044	349,047	350,405	350,586	351,296	(70,259)	[16,862]	{8,431}	351,999	(70,400)	[16,896]	{8,448}	352,683	(70,537)	[16,929]	{8,464}
San Diego	353,904	354,391	354,732	355,346	356,580	(71,316)	[17,116]	{8,558}	357,766	(71,553)	[17,173]	{8,586}	358,955	(71,791)	[17,230]	{8,615}
San Francisco	52,454	52,517	52,580	52,645	52,798	(10,560)	[2,534]	{1,267}	52,943	(10,589)	[2,541]	{1,271}	53,090	(10,618)	[2,548]	{1,274}
San Joaquin	98,682	98,848	99,013	99,163	99,529	(19,906)	[4,777]	{2,389}	99,880	(19,976)	[4,794]	{2,397}	100,218	(20,044)	[4,810]	{2,405}
San Luis Obispo	28,671	28,715	28,759	28,809	28,911	(5,782)	[1,388]	{694}	29,007	(5,801)	[1,392]	{696}	29,098	(5,820)	[1,397]	{698}
San Mateo	52,655	52,713	52,770	52,826	52,937	(10,587)	[2,541]	{1,270}	53,043	(10,609)	[2,546]	{1,273}	53,144	(10,629)	[2,551]	{1,275}
Santa Barbara	43,353	43,353	43,571	43,637	43,782	(8,756)	[2,102]	{1,051}	43,910	(8,782)	[2,108]	{1,054}	44,043	(8,809)	[2,114]	{1,057}
Santa Clara	141,165	141,166	141,810	141,945	142,238	(28,448)	[6,827]	{3,414}	142,525	(28,505)	[6,841]	{3,421}	142,803	(28,561)	[6,855]	{3,427}
Santa Cruz	20,295	20,314	20,334	20,347	20,385	(4,077)	[978]	{489}	20,420	(4,084)	[980]	{490}	20,454	(4,091)	[982]	{491}
Solano	44,444	44,452	44,658	44,703	44,815	(8,963)	[2,151]	{1,076}	44,921	(8,984)	[2,156]	{1,078}	45,025	(9,005)	[2,161]	{1,081}
Sonoma	39,704	39,752	39,799	39,844	39,928	(7,986)	[1,917]	{958}	40,006	(8,001)	[1,920]	{960}	40,084	(8,017)	[1,924]	{962}
Ventura	98,291	98,292	98,624	98,710	98,911	(19,782)	[4,748]	{2,374}	99,103	(19,821)	[4,757]	{2,378}	99,279	(19,856)	[4,765]	{2,383}

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.