

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 7/21/21**

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 7/21/21 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.

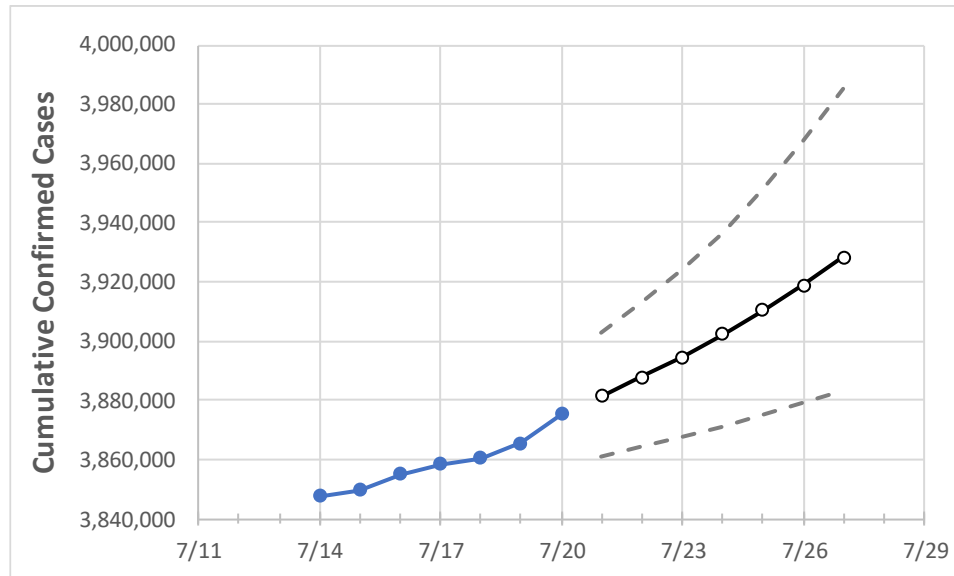
IEM's Modeling Lead

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:							
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	
California	3,858,391	3,860,499	3,865,655	3,875,420	3,881,387	3,887,751	3,894,652	3,902,282	3,910,420	3,918,999	3,928,421	

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:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
Alameda	92,372	92,580	92,584	92,973	93,210	93,472	93,735	94,031	94,341	94,672	95,031
Contra Costa	72,981	73,202	73,349	73,495	73,681	73,876	74,082	74,306	74,532	74,769	75,024
Fresno	103,136	103,217	103,298	103,350	103,438	103,531	103,631	103,738	103,855	103,978	104,111
Kern	111,756	111,825	111,894	111,894	111,973	112,058	112,147	112,241	112,341	112,447	112,560
Lake	3,782	3,803	3,825	3,848	3,874	3,902	3,933	3,966	4,002	4,040	4,083
Los Angeles	1,266,227	1,267,860	1,269,520	1,271,179	1,273,360	1,275,730	1,278,282	1,281,092	1,284,125	1,287,528	1,291,270
Marin	14,457	14,467	14,492	14,516	14,542	14,568	14,597	14,628	14,662	14,699	14,737
Monterey	44,131	44,157	44,182	44,208	44,232	44,256	44,282	44,309	44,337	44,366	44,397
Orange	276,537	276,831	277,126	277,489	277,881	278,301	278,755	279,243	279,766	280,326	280,936
Placer	24,258	24,286	24,313	24,359	24,398	24,437	24,476	24,517	24,561	24,604	24,654
Riverside	302,069	302,069	302,069	302,069	302,106	302,139	302,167	302,194	302,220	302,247	302,272
Sacramento	111,120	111,336	111,553	111,884	112,139	112,405	112,686	112,977	113,288	113,608	113,945
San Bernardino	302,302	302,365	302,429	303,166	303,421	303,709	304,012	304,332	304,695	305,085	305,512
San Diego	286,286	286,287	286,287	288,208	288,799	289,450	290,173	290,948	291,798	292,734	293,777
San Francisco	37,990	38,002	38,367	38,463	38,616	38,787	38,977	39,182	39,415	39,663	39,934
San Joaquin	75,714	75,820	75,927	76,034	76,140	76,253	76,374	76,506	76,646	76,800	76,963
San Luis Obispo	21,662	21,680	21,699	21,717	21,740	21,764	21,791	21,819	21,850	21,883	21,918
San Mateo	43,385	43,445	43,506	43,563	43,626	43,691	43,759	43,829	43,900	43,976	44,054
Santa Barbara	34,924	34,967	35,009	35,052	35,100	35,153	35,210	35,271	35,341	35,416	35,500
Santa Clara	120,738	120,873	121,007	121,159	121,337	121,527	121,733	121,950	122,185	122,438	122,710
Santa Cruz	16,400	16,413	16,425	16,425	16,440	16,455	16,471	16,489	16,508	16,528	16,550
Solano	34,663	34,696	34,728	34,761	34,821	34,882	34,947	35,012	35,080	35,152	35,226
Sonoma	31,763	31,800	31,838	31,875	31,928	31,981	32,035	32,090	32,145	32,203	32,264
Ventura	82,423	82,503	82,584	82,584	82,682	82,789	82,909	83,038	83,179	83,333	83,498

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:											
	7/17	7/18	7/19	7/20	7/22				7/24				7/26			
Alameda	92,372	92,580	92,584	92,973	93,472	(18,694)	[4,487]	{2,243}	94,031	(18,806)	[4,514]	{2,257}	94,672	(18,934)	[4,544]	{2,272}
Contra Costa	72,981	73,202	73,349	73,495	73,876	(14,775)	[3,546]	{1,773}	74,306	(14,861)	[3,567]	{1,783}	74,769	(14,954)	[3,589]	{1,794}
Fresno	103,136	103,217	103,298	103,350	103,531	(20,706)	[4,970]	{2,485}	103,738	(20,748)	[4,979]	{2,490}	103,978	(20,796)	[4,991]	{2,495}
Kern	111,756	111,825	111,894	111,894	112,058	(22,412)	[5,379]	{2,689}	112,241	(22,448)	[5,388]	{2,694}	112,447	(22,489)	[5,397]	{2,699}
Lake	3,782	3,803	3,825	3,848	3,902	(780)	[187]	{94}	3,966	(793)	[190]	{95}	4,040	(808)	[194]	{97}
Los Angeles	1,266,227	1,267,860	1,269,520	1,271,179	1,275,730	(255,146)	[61,235]	{30,618}	1,281,092	(256,218)	[61,492]	{30,746}	1,287,528	(257,506)	[61,801]	{30,901}
Marin	14,457	14,467	14,492	14,516	14,568	(2,914)	[699]	{350}	14,628	(2,926)	[702]	{351}	14,699	(2,940)	[706]	{353}
Monterey	44,131	44,157	44,182	44,208	44,256	(8,851)	[2,124]	{1,062}	44,309	(8,862)	[2,127]	{1,063}	44,366	(8,873)	[2,130]	{1,065}
Orange	276,537	276,831	277,126	277,489	278,301	(55,660)	[13,358]	{6,679}	279,243	(55,849)	[13,404]	{6,702}	280,326	(56,065)	[13,456]	{6,728}
Placer	24,258	24,286	24,313	24,359	24,437	(4,887)	[1,173]	{586}	24,517	(4,903)	[1,177]	{588}	24,604	(4,921)	[1,181]	{591}
Riverside	302,069	302,069	302,069	302,069	302,139	(60,428)	[14,503]	{7,251}	302,194	(60,439)	[14,505]	{7,253}	302,247	(60,449)	[14,508]	{7,254}
Sacramento	111,120	111,336	111,553	111,884	112,405	(22,481)	[5,395]	{2,698}	112,977	(22,595)	[5,423]	{2,711}	113,608	(22,722)	[5,453]	{2,727}
San Bernardino	302,302	302,365	302,429	303,166	303,709	(60,742)	[14,578]	{7,289}	304,332	(60,866)	[14,608]	{7,304}	305,085	(61,017)	[14,644]	{7,322}
San Diego	286,286	286,287	286,287	288,208	289,450	(57,890)	[13,894]	{6,947}	290,948	(58,190)	[13,966]	{6,983}	292,734	(58,547)	[14,051]	{7,026}
San Francisco	37,990	38,002	38,367	38,463	38,787	(7,757)	[1,862]	{931}	39,182	(7,836)	[1,881]	{940}	39,663	(7,933)	[1,904]	{952}
San Joaquin	75,714	75,820	75,927	76,034	76,253	(15,251)	[3,660]	{1,830}	76,506	(15,301)	[3,672]	{1,836}	76,800	(15,360)	[3,686]	{1,843}
San Luis Obispo	21,662	21,680	21,699	21,717	21,764	(4,353)	[1,045]	{522}	21,819	(4,364)	[1,047]	{524}	21,883	(4,377)	[1,050]	{525}
San Mateo	43,385	43,445	43,506	43,563	43,691	(8,738)	[2,097]	{1,049}	43,829	(8,766)	[2,104]	{1,052}	43,976	(8,795)	[2,111]	{1,055}
Santa Barbara	34,924	34,967	35,009	35,052	35,153	(7,031)	[1,687]	{844}	35,271	(7,054)	[1,693]	{847}	35,416	(7,083)	[1,700]	{850}
Santa Clara	120,738	120,873	121,007	121,159	121,527	(24,305)	[5,833]	{2,917}	121,950	(24,390)	[5,854]	{2,927}	122,438	(24,488)	[5,877]	{2,939}
Santa Cruz	16,400	16,413	16,425	16,425	16,455	(3,291)	[790]	{395}	16,489	(3,298)	[791]	{396}	16,528	(3,306)	[793]	{397}
Solano	34,663	34,696	34,728	34,761	34,882	(6,976)	[1,674]	{837}	35,012	(7,002)	[1,681]	{840}	35,152	(7,030)	[1,687]	{844}
Sonoma	31,763	31,800	31,838	31,875	31,981	(6,396)	[1,535]	{768}	32,090	(6,418)	[1,540]	{770}	32,203	(6,441)	[1,546]	{773}
Ventura	82,423	82,503	82,584	82,584	82,789	(16,558)	[3,974]	{1,987}	83,038	(16,608)	[3,986]	{1,993}	83,333	(16,667)	[4,000]	{2,000}

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.