

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

Date: 7/1/21

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 7/1/21 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.**

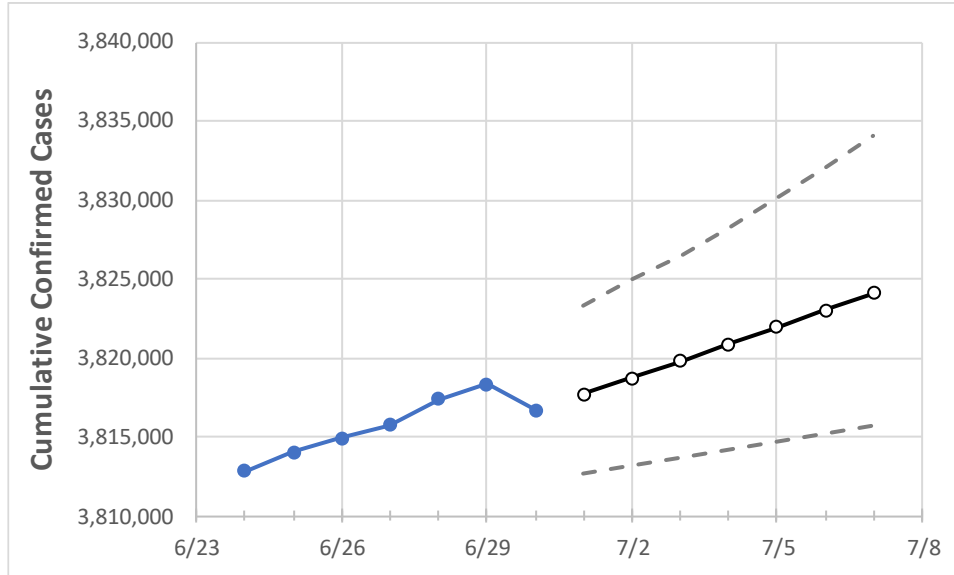
### IEM's Modeling Lead

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:						
	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7

California 3,815,751 3,817,372 3,818,303 3,816,659 3,817,695 3,818,725 3,819,769 3,820,862 3,821,944 3,823,014 3,824,104

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:							
	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	
Alameda	90,103	90,165	90,211	90,276	90,343	90,412	90,482	90,558	90,634	90,710	90,792	
Contra Costa	71,048	71,093	71,150	71,150	71,208	71,266	71,328	71,388	71,448	71,509	71,573	
Fresno	103,091	103,110	103,121	103,121	103,143	103,164	103,185	103,207	103,228	103,248	103,269	
Kern	111,015	111,049	111,055	111,060	111,084	111,108	111,133	111,157	111,181	111,204	111,227	
Lake	3,576	3,581	3,591	3,594	3,597	3,600	3,603	3,607	3,610	3,613	3,617	
Los Angeles	1,249,304	1,249,572	1,249,875	1,250,240	1,250,554	1,250,888	1,251,238	1,251,596	1,251,963	1,252,349	1,252,747	
Marin	14,224	14,227	14,236	14,236	14,240	14,244	14,248	14,252	14,256	14,261	14,265	
Monterey	43,868	43,875	43,885	43,885	43,890	43,896	43,901	43,907	43,912	43,918	43,924	
Orange	273,360	273,427	273,482	273,561	273,625	273,691	273,758	273,828	273,900	273,975	274,052	
Placer	23,702	23,751	23,756	23,755	23,777	23,799	23,822	23,845	23,868	23,890	23,912	
Riverside	301,709	301,691	301,673	301,655	301,811	301,980	302,166	302,366	302,585	302,826	303,088	
Sacramento	108,179	108,411	108,505	108,571	108,666	108,766	108,870	108,975	109,087	109,200	109,317	
San Bernardino	299,604	299,672	299,730	299,763	299,816	299,871	299,925	299,981	300,038	300,096	300,156	
San Diego	282,358	282,416	282,498	282,582	282,664	282,753	282,838	282,925	283,014	283,104	283,198	
San Francisco	37,348	37,360	37,372	37,041	37,053	37,066	37,079	37,091	37,103	37,116	37,129	
San Joaquin	74,874	74,887	74,900	74,900	74,915	74,929	74,942	74,954	74,965	74,977	74,987	
San Luis Obispo	21,472	21,477	21,482	21,482	21,486	21,491	21,495	21,499	21,503	21,508	21,512	
San Mateo	42,898	42,925	42,927	42,540	42,571	42,604	42,637	42,669	42,704	42,740	42,777	
Santa Barbara	34,651	34,659	34,626	34,626	34,633	34,639	34,646	34,653	34,660	34,667	34,674	
Santa Clara	120,321	120,352	120,377	119,357	119,391	119,423	119,458	119,493	119,527	119,564	119,598	
Santa Cruz	16,267	16,269	16,269	16,269	16,272	16,276	16,279	16,283	16,286	16,290	16,294	
Solano	33,881	33,898	33,936	33,973	34,000	34,029	34,057	34,088	34,118	34,149	34,182	
Sonoma	31,116	31,129	31,137	31,026	31,050	31,073	31,098	31,121	31,144	31,167	31,189	
Ventura	81,767	81,776	81,830	81,884	81,906	81,927	81,949	81,973	81,998	82,025	82,049	

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:											
	6/27	6/28	6/29	6/30	7/2			7/4			7/6					
Alameda	90,103	90,165	90,211	90,276	90,412	(18,082)	[4,340]	{2,170}	90,558	(18,112)	[4,347]	{2,173}	90,710	(18,142)	[4,354]	{2,177}
Contra Costa	71,048	71,093	71,150	71,150	71,266	(14,253)	[3,421]	{1,710}	71,388	(14,278)	[3,427]	{1,713}	71,509	(14,302)	[3,432]	{1,716}
Fresno	103,091	103,110	103,121	103,121	103,164	(20,633)	[4,952]	{2,476}	103,207	(20,641)	[4,954]	{2,477}	103,248	(20,650)	[4,956]	{2,478}
Kern	111,015	111,049	111,055	111,060	111,108	(22,222)	[5,333]	{2,667}	111,157	(22,231)	[5,336]	{2,668}	111,204	(22,241)	[5,338]	{2,669}
Lake	3,576	3,581	3,591	3,594	3,600	(720)	[173]	{86}	3,607	(721)	[173]	{87}	3,613	(723)	[173]	{87}
Los Angeles	1,249,304	1,249,572	1,249,875	1,250,240	1,250,888	(250,178)	[60,043]	{30,021}	1,251,596	(250,319)	[60,077]	{30,038}	1,252,349	(250,470)	[60,113]	{30,056}
Marin	14,224	14,227	14,236	14,236	14,244	(2,849)	[684]	{342}	14,252	(2,850)	[684]	{342}	14,261	(2,852)	[685]	{342}
Monterey	43,868	43,875	43,885	43,885	43,896	(8,779)	[2,107]	{1,053}	43,907	(8,781)	[2,108]	{1,054}	43,918	(8,784)	[2,108]	{1,054}
Orange	273,360	273,427	273,482	273,561	273,691	(54,738)	[13,137]	{6,569}	273,828	(54,766)	[13,144]	{6,572}	273,975	(54,795)	[13,151]	{6,575}
Placer	23,702	23,751	23,756	23,755	23,799	(4,760)	[1,142]	{571}	23,845	(4,769)	[1,145]	{572}	23,890	(4,778)	[1,147]	{573}
Riverside	301,709	301,691	301,673	301,655	301,980	(60,396)	[14,495]	{7,248}	302,366	(60,473)	[14,514]	{7,257}	302,826	(60,565)	[14,536]	{7,268}
Sacramento	108,179	108,411	108,505	108,571	108,766	(21,753)	[5,221]	{2,610}	108,975	(21,795)	[5,231]	{2,615}	109,200	(21,840)	[5,242]	{2,621}
San Bernardino	299,604	299,672	299,730	299,763	299,871	(59,974)	[14,394]	{7,197}	299,981	(59,996)	[14,399]	{7,200}	300,096	(60,019)	[14,405]	{7,202}
San Diego	282,358	282,416	282,498	282,582	282,753	(56,551)	[13,572]	{6,786}	282,925	(56,585)	[13,580]	{6,790}	283,104	(56,621)	[13,589]	{6,794}
San Francisco	37,348	37,360	37,372	37,041	37,066	(7,413)	[1,779]	{890}	37,091	(7,418)	[1,780]	{890}	37,116	(7,423)	[1,782]	{891}
San Joaquin	74,874	74,887	74,900	74,900	74,929	(14,986)	[3,597]	{1,798}	74,954	(14,991)	[3,598]	{1,799}	74,977	(14,995)	[3,599]	{1,799}
San Luis Obispo	21,472	21,477	21,482	21,482	21,491	(4,298)	[1,032]	{516}	21,499	(4,300)	[1,032]	{516}	21,508	(4,302)	[1,032]	{516}
San Mateo	42,898	42,925	42,927	42,540	42,604	(8,521)	[2,045]	{1,022}	42,669	(8,534)	[2,048]	{1,024}	42,740	(8,548)	[2,052]	{1,026}
Santa Barbara	34,651	34,659	34,626	34,626	34,639	(6,928)	[1,663]	{831}	34,653	(6,931)	[1,663]	{832}	34,667	(6,933)	[1,664]	{832}
Santa Clara	120,321	120,352	120,377	119,357	119,423	(23,885)	[5,732]	{2,866}	119,493	(23,899)	[5,736]	{2,868}	119,564	(23,913)	[5,739]	{2,870}
Santa Cruz	16,267	16,269	16,269	16,269	16,276	(3,255)	[781]	{391}	16,283	(3,257)	[782]	{391}	16,290	(3,258)	[782]	{391}
Solano	33,881	33,898	33,936	33,973	34,029	(6,806)	[1,633]	{817}	34,088	(6,818)	[1,636]	{818}	34,149	(6,830)	[1,639]	{820}
Sonoma	31,116	31,129	31,137	31,026	31,073	(6,215)	[1,492]	{746}	31,121	(6,224)	[1,494]	{747}	31,167	(6,233)	[1,496]	{748}
Ventura	81,767	81,776	81,830	81,884	81,927	(16,385)	[3,933]	{1,966}	81,973	(16,395)	[3,935]	{1,967}	82,025	(16,405)	[3,937]	{1,969}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.