

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

Date: 9/27/21

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 9/27/21 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.**

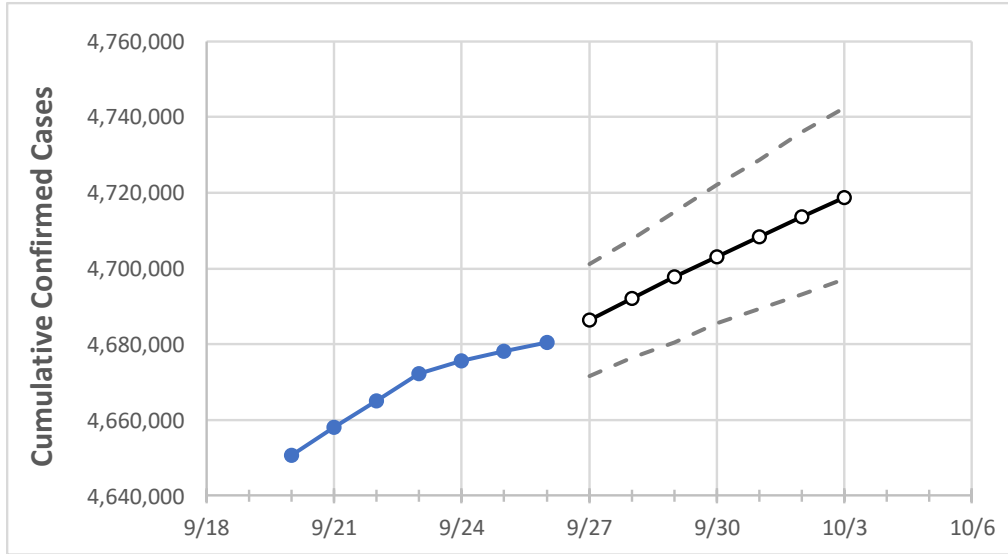
### IEM's Modeling Lead

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
California	4,672,284	4,675,686	4,678,038	4,680,552	4,686,418	4,692,135	4,697,696	4,702,978	4,708,459	4,713,674	4,718,736

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Alameda	116,800	116,800	116,800	116,800	116,945	117,092	117,230	117,364	117,504	117,634	117,763
Contra Costa	96,331	96,331	96,331	96,331	96,458	96,584	96,696	96,814	96,930	97,042	97,150
Fresno	137,387	137,387	137,387	137,387	137,694	138,018	138,323	138,640	138,937	139,251	139,531
Kern	136,806	136,932	136,932	136,932	137,360	137,797	138,229	138,641	139,073	139,490	139,905
Lake	6,135	6,135	6,135	6,135	6,154	6,172	6,190	6,208	6,223	6,241	6,257
Los Angeles	1,449,923	1,451,438	1,452,998	1,454,172	1,455,631	1,457,068	1,458,460	1,459,883	1,461,234	1,462,607	1,463,965
Marin	17,200	17,200	17,200	17,200	17,225	17,249	17,273	17,297	17,322	17,345	17,369
Monterey	49,732	49,732	49,733	49,733	49,765	49,796	49,824	49,855	49,883	49,912	49,938
Orange	315,774	316,221	316,221	316,221	316,587	316,957	317,321	317,673	318,023	318,375	318,721
Placer	37,032	37,032	37,033	37,033	37,105	37,172	37,236	37,302	37,365	37,428	37,482
Riverside	360,056	360,057	360,057	360,058	360,427	360,767	361,107	361,449	361,797	362,134	362,461
Sacramento	151,658	151,658	151,659	151,659	151,874	152,073	152,245	152,428	152,605	152,781	152,949
San Bernardino	349,037	349,040	349,044	349,047	349,369	349,687	349,974	350,256	350,578	350,862	351,130
San Diego	352,019	353,112	353,904	354,391	355,030	355,665	356,303	356,916	357,539	358,159	358,780
San Francisco	52,328	52,328	52,328	52,328	52,422	52,511	52,597	52,690	52,779	52,869	52,952
San Joaquin	98,351	98,351	98,351	98,351	98,580	98,790	99,016	99,227	99,449	99,671	99,879
San Luis Obispo	28,582	28,582	28,582	28,582	28,643	28,701	28,758	28,816	28,873	28,929	28,981
San Mateo	52,540	52,540	52,540	52,540	52,604	52,668	52,729	52,787	52,847	52,904	52,962
Santa Barbara	43,352	43,352	43,353	43,353	43,426	43,489	43,552	43,612	43,669	43,739	43,790
Santa Clara	141,163	141,164	141,165	141,166	141,282	141,400	141,503	141,610	141,708	141,818	141,909
Santa Cruz	20,255	20,255	20,255	20,255	20,278	20,300	20,322	20,343	20,364	20,384	20,405
Solano	44,429	44,437	44,444	44,452	44,501	44,547	44,591	44,634	44,675	44,717	44,754
Sonoma	39,609	39,609	39,609	39,609	39,654	39,698	39,739	39,779	39,821	39,862	39,899
Ventura	98,290	98,291	98,291	98,292	98,373	98,459	98,531	98,607	98,678	98,754	98,819

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:											
	9/23	9/24	9/25	9/26	9/28				9/30				10/2			
Alameda	116,800	116,800	116,800	116,800	117,092	(23,418)	[5,620]	{2,810}	117,364	(23,473)	[5,633]	{2,817}	117,634	(23,527)	[5,646]	{2,823}
Contra Costa	96,331	96,331	96,331	96,331	96,584	(19,317)	[4,636]	{2,318}	96,814	(19,363)	[4,647]	{2,324}	97,042	(19,408)	[4,658]	{2,329}
Fresno	137,387	137,387	137,387	137,387	138,018	(27,604)	[6,625]	{3,312}	138,640	(27,728)	[6,655]	{3,327}	139,251	(27,850)	[6,684]	{3,342}
Kern	136,806	136,932	136,932	136,932	137,797	(27,559)	[6,614]	{3,307}	138,641	(27,728)	[6,655]	{3,327}	139,490	(27,898)	[6,696]	{3,348}
Lake	6,135	6,135	6,135	6,135	6,172	(1,234)	[296]	{148}	6,208	(1,242)	[298]	{149}	6,241	(1,248)	[300]	{150}
Los Angeles	1,449,923	1,451,438	1,452,998	1,454,172	1,457,068	(291,414)	[69,939]	{34,970}	1,459,883	(291,977)	[70,074]	{35,037}	1,462,607	(292,521)	[70,205]	{35,103}
Marin	17,200	17,200	17,200	17,200	17,249	(3,450)	[828]	{414}	17,297	(3,459)	[830]	{415}	17,345	(3,469)	[833]	{416}
Monterey	49,732	49,732	49,733	49,733	49,796	(9,959)	[2,390]	{1,195}	49,855	(9,971)	[2,393]	{1,197}	49,912	(9,982)	[2,396]	{1,198}
Orange	315,774	316,221	316,221	316,221	316,957	(63,391)	[15,214]	{7,607}	317,673	(63,535)	[15,248]	{7,624}	318,375	(63,675)	[15,282]	{7,641}
Placer	37,032	37,032	37,033	37,033	37,172	(7,434)	[1,784]	{892}	37,302	(7,460)	[1,790]	{895}	37,428	(7,486)	[1,797]	{898}
Riverside	360,056	360,057	360,057	360,058	360,767	(72,153)	[17,317]	{8,658}	361,449	(72,290)	[17,350]	{8,675}	362,134	(72,427)	[17,382]	{8,691}
Sacramento	151,658	151,658	151,659	151,659	152,073	(30,415)	[7,300]	{3,650}	152,428	(30,486)	[7,317]	{3,658}	152,781	(30,556)	[7,333]	{3,667}
San Bernardino	349,037	349,040	349,044	349,047	349,687	(69,937)	[16,785]	{8,392}	350,256	(70,051)	[16,812]	{8,406}	350,862	(70,172)	[16,841]	{8,421}
San Diego	352,019	353,112	353,904	354,391	355,665	(71,133)	[17,072]	{8,536}	356,916	(71,383)	[17,132]	{8,566}	358,159	(71,632)	[17,192]	{8,596}
San Francisco	52,328	52,328	52,328	52,328	52,511	(10,502)	[2,521]	{1,260}	52,690	(10,538)	[2,529]	{1,265}	52,869	(10,574)	[2,538]	{1,269}
San Joaquin	98,351	98,351	98,351	98,351	98,790	(19,758)	[4,742]	{2,371}	99,227	(19,845)	[4,763]	{2,381}	99,671	(19,934)	[4,784]	{2,392}
San Luis Obispo	28,582	28,582	28,582	28,582	28,701	(5,740)	[1,378]	{689}	28,816	(5,763)	[1,383]	{692}	28,929	(5,786)	[1,389]	{694}
San Mateo	52,540	52,540	52,540	52,540	52,668	(10,534)	[2,528]	{1,264}	52,787	(10,557)	[2,534]	{1,267}	52,904	(10,581)	[2,539]	{1,270}
Santa Barbara	43,352	43,352	43,353	43,353	43,489	(8,698)	[2,087]	{1,044}	43,612	(8,722)	[2,093]	{1,047}	43,739	(8,748)	[2,099]	{1,050}
Santa Clara	141,163	141,164	141,165	141,166	141,400	(28,280)	[6,787]	{3,394}	141,610	(28,322)	[6,797]	{3,399}	141,818	(28,364)	[6,807]	{3,404}
Santa Cruz	20,255	20,255	20,255	20,255	20,300	(4,060)	[974]	{487}	20,343	(4,069)	[976]	{488}	20,384	(4,077)	[978]	{489}
Solano	44,429	44,437	44,444	44,452	44,547	(8,909)	[2,138]	{1,069}	44,634	(8,927)	[2,142]	{1,071}	44,717	(8,943)	[2,146]	{1,073}
Sonoma	39,609	39,609	39,609	39,609	39,698	(7,940)	[1,906]	{953}	39,779	(7,956)	[1,909]	{955}	39,862	(7,972)	[1,913]	{957}
Ventura	98,290	98,291	98,291	98,292	98,459	(19,692)	[4,726]	{2,363}	98,607	(19,721)	[4,733]	{2,367}	98,754	(19,751)	[4,740]	{2,370}

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.