

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/4/21**

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 10/4/21 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.

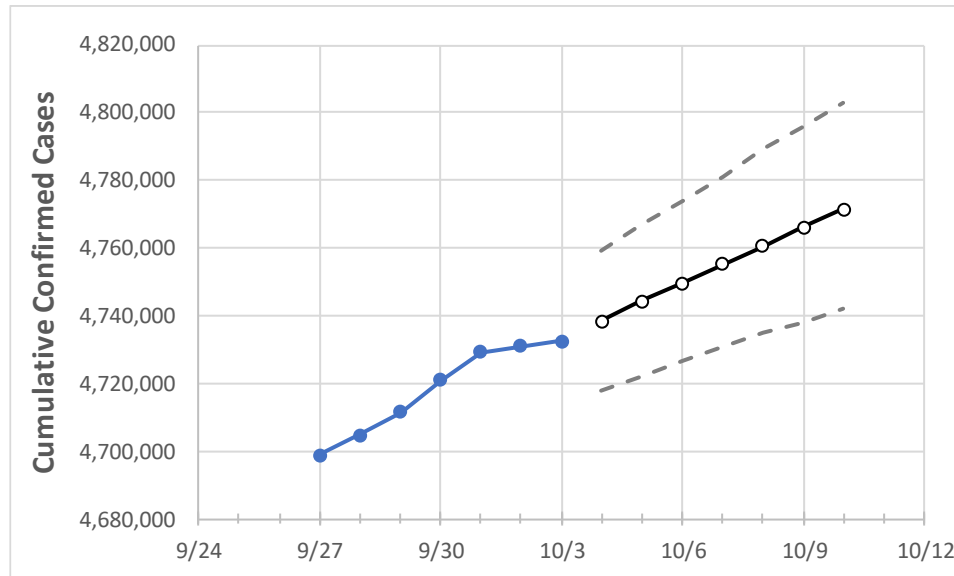
IEM's Modeling Lead

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:						
	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10
California	4,720,860	4,729,153	4,731,043	4,732,419	4,738,484	4,744,182	4,749,713	4,755,105	4,760,641	4,766,075	4,771,405

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:						
	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10
Alameda	117,811	117,998	117,998	117,998	118,131	118,264	118,393	118,521	118,647	118,775	118,895
Contra Costa	97,261	97,417	97,417	97,417	97,539	97,660	97,782	97,898	98,014	98,129	98,240
Fresno	139,353	139,735	139,735	139,735	140,015	140,298	140,571	140,848	141,131	141,402	141,671
Kern	139,021	139,554	139,554	139,554	139,892	140,222	140,553	140,876	141,190	141,514	141,837
Lake	6,274	6,301	6,301	6,301	6,320	6,340	6,358	6,377	6,396	6,415	6,432
Los Angeles	1,459,182	1,460,645	1,462,013	1,463,039	1,464,275	1,465,516	1,466,743	1,467,967	1,469,131	1,470,331	1,471,492
Marin	17,334	17,349	17,349	17,349	17,369	17,388	17,408	17,427	17,447	17,466	17,486
Monterey	50,161	50,208	50,208	50,208	50,261	50,313	50,369	50,422	50,469	50,529	50,587
Orange	319,132	319,458	319,458	319,458	319,878	320,301	320,709	321,126	321,537	321,954	322,374
Placer	37,636	37,742	37,742	37,742	37,817	37,896	37,976	38,057	38,132	38,209	38,278
Riverside	363,281	363,950	363,950	363,950	364,429	364,873	365,276	365,720	366,156	366,655	367,102
Sacramento	153,769	153,980	153,980	153,980	154,225	154,448	154,710	154,966	155,217	155,469	155,689
San Bernardino	351,423	351,963	351,963	351,963	352,330	352,671	353,030	353,359	353,680	354,048	354,351
San Diego	356,427	357,254	357,776	358,126	358,704	359,259	359,804	360,360	360,897	361,464	361,976
San Francisco	52,812	52,919	52,919	52,919	52,994	53,067	53,139	53,210	53,279	53,350	53,420
San Joaquin	99,527	99,770	99,770	99,770	99,946	100,108	100,272	100,441	100,596	100,760	100,914
San Luis Obispo	28,960	29,075	29,075	29,075	29,136	29,195	29,256	29,315	29,375	29,434	29,493
San Mateo	53,012	53,106	53,106	53,106	53,172	53,239	53,306	53,372	53,436	53,500	53,566
Santa Barbara	43,953	44,048	44,048	44,048	44,130	44,203	44,280	44,357	44,433	44,512	44,592
Santa Clara	142,191	142,386	142,386	142,386	142,524	142,655	142,793	142,932	143,062	143,181	143,310
Santa Cruz	20,478	20,514	20,514	20,514	20,543	20,573	20,602	20,631	20,660	20,690	20,720
Solano	44,864	44,940	44,940	44,940	44,995	45,053	45,104	45,159	45,213	45,269	45,320
Sonoma	39,930	40,001	40,001	40,001	40,042	40,083	40,124	40,163	40,202	40,240	40,277
Ventura	99,034	99,135	99,135	99,135	99,238	99,340	99,439	99,542	99,636	99,739	99,830

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:											
	9/30	10/1	10/2	10/3	10/5				10/7				10/9			
Alameda	117,811	117,998	117,998	117,998	118,264	(23,653)	[5,677]	{2,838}	118,521	(23,704)	[5,689]	{2,844}	118,775	(23,755)	[5,701]	{2,851}
Contra Costa	97,261	97,417	97,417	97,417	97,660	(19,532)	[4,688]	{2,344}	97,898	(19,580)	[4,699]	{2,350}	98,129	(19,626)	[4,710]	{2,355}
Fresno	139,353	139,735	139,735	139,735	140,298	(28,060)	[6,734]	{3,367}	140,848	(28,170)	[6,761]	{3,380}	141,402	(28,280)	[6,787]	{3,394}
Kern	139,021	139,554	139,554	139,554	140,222	(28,044)	[6,731]	{3,365}	140,876	(28,175)	[6,762]	{3,381}	141,514	(28,303)	[6,793]	{3,396}
Lake	6,274	6,301	6,301	6,301	6,340	(1,268)	[304]	{152}	6,377	(1,275)	[306]	{153}	6,415	(1,283)	[308]	{154}
Los Angeles	1,459,182	1,460,645	1,462,013	1,463,039	1,465,516	(293,103)	[70,345]	{35,172}	1,467,967	(293,593)	[70,462]	{35,231}	1,470,331	(294,066)	[70,576]	{35,288}
Marin	17,334	17,349	17,349	17,349	17,388	(3,478)	[835]	{417}	17,427	(3,485)	[837]	{418}	17,466	(3,493)	[838]	{419}
Monterey	50,161	50,208	50,208	50,208	50,313	(10,063)	[2,415]	{1,208}	50,422	(10,084)	[2,420]	{1,210}	50,529	(10,106)	[2,425]	{1,213}
Orange	319,132	319,458	319,458	319,458	320,301	(64,060)	[15,374]	{7,687}	321,126	(64,225)	[15,414]	{7,707}	321,954	(64,391)	[15,454]	{7,727}
Placer	37,636	37,742	37,742	37,742	37,896	(7,579)	[1,819]	{909}	38,057	(7,611)	[1,827]	{913}	38,209	(7,642)	[1,834]	{917}
Riverside	363,281	363,950	363,950	363,950	364,873	(72,975)	[17,514]	{8,757}	365,720	(73,144)	[17,555]	{8,777}	366,655	(73,331)	[17,599]	{8,800}
Sacramento	153,769	153,980	153,980	153,980	154,448	(30,890)	[7,413]	{3,707}	154,966	(30,993)	[7,438]	{3,719}	155,469	(31,094)	[7,463]	{3,731}
San Bernardino	351,423	351,963	351,963	351,963	352,671	(70,534)	[16,928]	{8,464}	353,359	(70,672)	[16,961]	{8,481}	354,048	(70,810)	[16,994]	{8,497}
San Diego	356,427	357,254	357,776	358,126	359,259	(71,852)	[17,244]	{8,622}	360,360	(72,072)	[17,297]	{8,649}	361,464	(72,293)	[17,350]	{8,675}
San Francisco	52,812	52,919	52,919	52,919	53,067	(10,613)	[2,547]	{1,274}	53,210	(10,642)	[2,554]	{1,277}	53,350	(10,670)	[2,561]	{1,280}
San Joaquin	99,527	99,770	99,770	99,770	100,108	(20,022)	[4,805]	{2,403}	100,441	(20,088)	[4,821]	{2,411}	100,760	(20,152)	[4,836]	{2,418}
San Luis Obispo	28,960	29,075	29,075	29,075	29,195	(5,839)	[1,401]	{701}	29,315	(5,863)	[1,407]	{704}	29,434	(5,887)	[1,413]	{706}
San Mateo	53,012	53,106	53,106	53,106	53,239	(10,648)	[2,555]	{1,278}	53,372	(10,674)	[2,562]	{1,281}	53,500	(10,700)	[2,568]	{1,284}
Santa Barbara	43,953	44,048	44,048	44,048	44,203	(8,841)	[2,122]	{1,061}	44,357	(8,871)	[2,129]	{1,065}	44,512	(8,902)	[2,137]	{1,068}
Santa Clara	142,191	142,386	142,386	142,386	142,655	(28,531)	[6,847]	{3,424}	142,932	(28,586)	[6,861]	{3,430}	143,181	(28,636)	[6,873]	{3,436}
Santa Cruz	20,478	20,514	20,514	20,514	20,573	(4,115)	[988]	{494}	20,631	(4,126)	[990]	{495}	20,690	(4,138)	[993]	{497}
Solano	44,864	44,940	44,940	44,940	45,053	(9,011)	[2,163]	{1,081}	45,159	(9,032)	[2,168]	{1,084}	45,269	(9,054)	[2,173]	{1,086}
Sonoma	39,930	40,001	40,001	40,001	40,083	(8,017)	[1,924]	{962}	40,163	(8,033)	[1,928]	{964}	40,240	(8,048)	[1,932]	{966}
Ventura	99,034	99,135	99,135	99,135	99,340	(19,868)	[4,768]	{2,384}	99,542	(19,908)	[4,778]	{2,389}	99,739	(19,948)	[4,787]	{2,394}

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.