

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 9/10/20**

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 9/10/20 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.

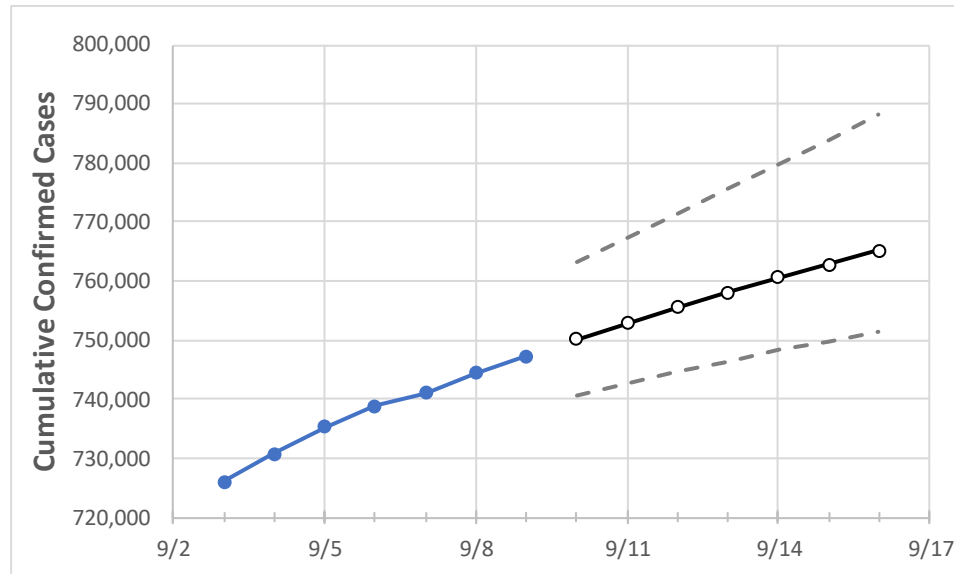
IEM's Modeling Lead

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:					
	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16
California	738,856	740,965	744,344	747,290	750,173	752,936	755,584	758,123	760,555	762,887	765,121

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 20%, and are often within 10%, of actual confirmed cases.

California Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16
Alameda	19,241	19,350	19,496	19,596	19,714	19,829	19,942	20,052	20,160	20,266	20,369
Contra Costa	14,527	14,639	14,712	14,740	14,804	14,865	14,923	14,978	15,032	15,082	15,131
Fresno	26,325	26,471	26,565	26,640	26,756	26,865	26,969	27,068	27,161	27,250	27,334
Kern	30,040	30,080	30,179	30,202	30,267	30,328	30,386	30,441	30,493	30,542	30,589
Los Angeles	248,334	248,821	249,241	249,859	250,470	251,051	251,604	252,130	252,630	253,107	253,560
Marin	6,310	6,339	6,354	6,368	6,388	6,407	6,425	6,443	6,461	6,478	6,494
Monterey	8,439	8,570	8,629	8,661	8,728	8,793	8,858	8,922	8,984	9,047	9,108
Orange	49,732	49,845	49,996	50,190	50,308	50,421	50,528	50,631	50,728	50,821	50,909
Placer	3,182	3,201	3,220	3,238	3,263	3,288	3,313	3,338	3,363	3,387	3,412
Riverside	54,280	54,426	54,572	54,735	54,857	54,974	55,087	55,196	55,302	55,403	55,501
Sacramento	18,955	19,128	19,460	19,524	19,661	19,795	19,928	20,058	20,186	20,313	20,437
San Bernardino	49,558	49,691	49,800	49,909	50,068	50,218	50,360	50,494	50,620	50,740	50,853
San Diego	40,650	40,652	40,868	41,324	41,464	41,598	41,725	41,846	41,961	42,071	42,175
San Francisco	9,915	9,979	10,027	10,074	10,131	10,186	10,240	10,293	10,344	10,395	10,444
San Joaquin	18,557	18,558	18,558	18,558	18,622	18,684	18,743	18,801	18,856	18,908	18,959
San Luis Obispo	3,083	3,101	3,116	3,145	3,161	3,175	3,190	3,203	3,216	3,229	3,241
San Mateo	8,661	8,706	8,750	8,807	8,865	8,923	8,980	9,037	9,092	9,147	9,202
Santa Barbara	8,404	8,434	8,479	8,499	8,527	8,553	8,580	8,605	8,631	8,655	8,679
Santa Clara	18,611	18,664	18,717	18,854	18,978	19,100	19,219	19,336	19,451	19,564	19,675
Santa Cruz	1,931	1,931	1,931	1,931	1,959	1,989	2,021	2,055	2,091	2,129	2,170
Solano	5,717	5,739	5,762	5,778	5,799	5,818	5,837	5,854	5,871	5,887	5,901
Sonoma	6,303	6,360	6,488	6,516	6,564	6,611	6,656	6,700	6,743	6,785	6,826
Ventura	11,254	11,315	11,463	11,475	11,522	11,567	11,611	11,653	11,694	11,734	11,772

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:											
	9/6	9/7	9/8	9/9	9/11				9/13				9/15			
Alameda	19,241	19,350	19,496	19,596	19,829	(3,966)	[952]	{476}	20,052	(4,010)	[963]	{481}	20,266	(4,053)	[973]	{486}
Contra Costa	14,527	14,639	14,712	14,740	14,865	(2,973)	[713]	{357}	14,978	(2,996)	[719]	{359}	15,082	(3,016)	[724]	{362}
Fresno	26,325	26,471	26,565	26,640	26,865	(5,373)	[1,290]	{645}	27,068	(5,414)	[1,299]	{650}	27,250	(5,450)	[1,308]	{654}
Kern	30,040	30,080	30,179	30,202	30,328	(6,066)	[1,456]	{728}	30,441	(6,088)	[1,461]	{731}	30,542	(6,108)	[1,466]	{733}
Los Angeles	248,334	248,821	249,241	249,859	251,051	(50,210)	[12,050]	{6,025}	252,130	(50,426)	[12,102]	{6,051}	253,107	(50,621)	[12,149]	{6,075}
Marin	6,310	6,339	6,354	6,368	6,407	(1,281)	[308]	{154}	6,443	(1,289)	[309]	{155}	6,478	(1,296)	[311]	{155}
Monterey	8,439	8,570	8,629	8,661	8,793	(1,759)	[422]	{211}	8,922	(1,784)	[428]	{214}	9,047	(1,809)	[434]	{217}
Orange	49,732	49,845	49,996	50,190	50,421	(10,084)	[2,420]	{1,210}	50,631	(10,126)	[2,430]	{1,215}	50,821	(10,164)	[2,439]	{1,220}
Placer	3,182	3,201	3,220	3,238	3,288	(658)	[158]	{79}	3,338	(668)	[160]	{80}	3,387	(677)	[163]	{81}
Riverside	54,280	54,426	54,572	54,735	54,974	(10,995)	[2,639]	{1,319}	55,196	(11,039)	[2,649]	{1,325}	55,403	(11,081)	[2,659]	{1,330}
Sacramento	18,955	19,128	19,460	19,524	19,795	(3,959)	[950]	{475}	20,058	(4,012)	[963]	{481}	20,313	(4,063)	[975]	{488}
San Bernardino	49,558	49,691	49,800	49,909	50,218	(10,044)	[2,410]	{1,205}	50,494	(10,099)	[2,424]	{1,212}	50,740	(10,148)	[2,436]	{1,218}
San Diego	40,650	40,652	40,868	41,324	41,598	(8,320)	[1,997]	{998}	41,846	(8,369)	[2,009]	{1,004}	42,071	(8,414)	[2,019]	{1,010}
San Francisco	9,915	9,979	10,027	10,074	10,186	(2,037)	[489]	{244}	10,293	(2,059)	[494]	{247}	10,395	(2,079)	[499]	{249}
San Joaquin	18,557	18,558	18,558	18,558	18,684	(3,737)	[897]	{448}	18,801	(3,760)	[902]	{451}	18,908	(3,782)	[908]	{454}
San Luis Obispo	3,083	3,101	3,116	3,145	3,175	(635)	[152]	{76}	3,203	(641)	[154]	{77}	3,229	(646)	[155]	{77}
San Mateo	8,661	8,706	8,750	8,807	8,923	(1,785)	[428]	{214}	9,037	(1,807)	[434]	{217}	9,147	(1,829)	[439]	{220}
Santa Barbara	8,404	8,434	8,479	8,499	8,553	(1,711)	[411]	{205}	8,605	(1,721)	[413]	{207}	8,655	(1,731)	[415]	{208}
Santa Clara	18,611	18,664	18,717	18,854	19,100	(3,820)	[917]	{458}	19,336	(3,867)	[928]	{464}	19,564	(3,913)	[939]	{470}
Santa Cruz	1,931	1,931	1,931	1,931	1,989	(398)	[95]	{48}	2,055	(411)	[99]	{49}	2,129	(426)	[102]	{51}
Solano	5,717	5,739	5,762	5,778	5,818	(1,164)	[279]	{140}	5,854	(1,171)	[281]	{141}	5,887	(1,177)	[283]	{141}
Sonoma	6,303	6,360	6,488	6,516	6,611	(1,322)	[317]	{159}	6,700	(1,340)	[322]	{161}	6,785	(1,357)	[326]	{163}
Ventura	11,254	11,315	11,463	11,475	11,567	(2,313)	[555]	{278}	11,653	(2,331)	[559]	{280}	11,734	(2,347)	[563]	{282}

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.