

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

Date: 8/27/20

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 8/27/20 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.

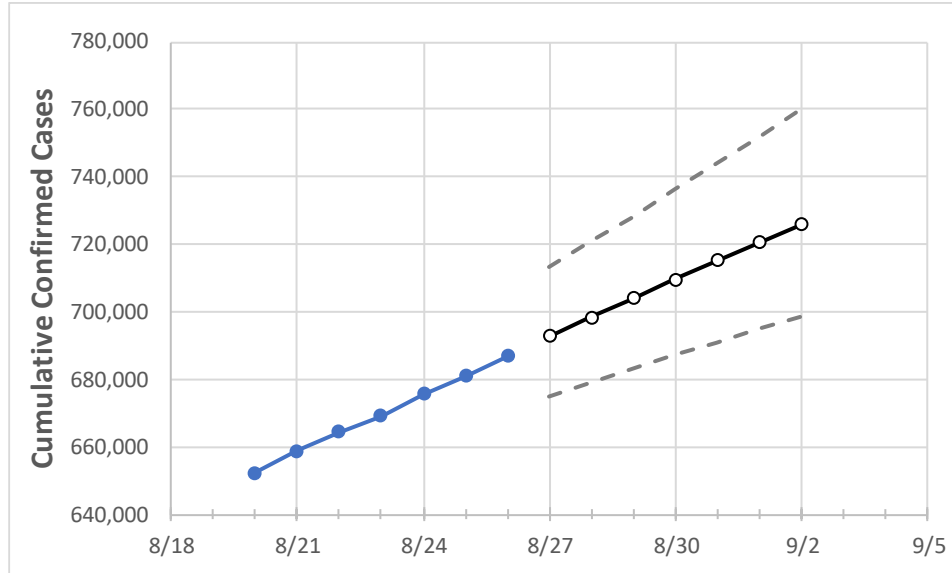
IEM's Modeling Lead

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:						
	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30	8/31	9/1	9/2
California	669,280	675,561	681,032	687,004	692,756	698,446	704,072	709,639	715,144	720,590	725,978

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:							
	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30	8/31	9/1	9/2	
Alameda	16,723	16,786	17,275	17,385	17,543	17,701	17,861	18,022	18,184	18,348	18,512	
Contra Costa	12,527	12,663	12,906	13,181	13,337	13,492	13,647	13,801	13,954	14,107	14,258	
Fresno	23,197	23,414	23,618	23,932	24,307	24,688	25,075	25,467	25,866	26,271	26,682	
Kern	27,915	28,140	28,234	28,520	28,667	28,808	28,943	29,073	29,197	29,316	29,430	
Los Angeles	231,695	232,893	233,777	235,386	236,361	237,314	238,248	239,160	240,053	240,927	241,782	
Marin	5,905	5,930	5,942	5,965	5,983	6,000	6,017	6,033	6,049	6,065	6,080	
Monterey	7,081	7,226	7,274	7,393	7,493	7,594	7,697	7,801	7,907	8,014	8,122	
Orange	45,954	46,307	46,642	47,090	47,413	47,735	48,056	48,376	48,695	49,013	49,330	
Placer	2,777	2,795	2,833	2,852	2,873	2,894	2,914	2,933	2,953	2,971	2,990	
Riverside	49,944	50,744	51,200	51,538	51,947	52,353	52,754	53,152	53,546	53,936	54,322	
Sacramento	15,516	16,331	16,623	16,742	16,845	16,945	17,042	17,137	17,229	17,318	17,405	
San Bernardino	45,035	45,246	45,666	46,051	46,502	46,952	47,402	47,852	48,300	48,748	49,196	
San Diego	36,540	36,727	36,994	37,222	37,446	37,667	37,886	38,103	38,317	38,529	38,739	
San Francisco	8,871	8,936	8,981	9,060	9,128	9,195	9,261	9,327	9,392	9,456	9,519	
San Joaquin	16,068	16,131	16,565	16,795	16,960	17,126	17,294	17,462	17,632	17,803	17,976	
San Luis Obispo	2,672	2,679	2,735	2,769	2,787	2,804	2,821	2,838	2,854	2,869	2,885	
San Mateo	7,603	7,670	7,788	7,849	7,934	8,019	8,104	8,189	8,274	8,359	8,444	
Santa Barbara	7,685	7,725	7,800	7,869	7,911	7,952	7,994	8,036	8,078	8,120	8,162	
Santa Clara	15,688	16,151	16,229	16,306	16,461	16,616	16,771	16,926	17,080	17,234	17,388	
Santa Cruz	1,628	1,636	1,698	1,714	1,737	1,760	1,784	1,808	1,833	1,858	1,884	
Solano	5,153	5,206	5,231	5,280	5,327	5,373	5,419	5,465	5,511	5,557	5,602	
Sonoma	5,120	5,212	5,351	5,422	5,531	5,643	5,758	5,876	5,997	6,121	6,248	
Ventura	9,959	10,126	10,261	10,313	10,399	10,485	10,571	10,658	10,745	10,832	10,920	

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:											
	8/23	8/24	8/25	8/26	8/28				8/30				9/1			
Alameda	16,723	16,786	17,275	17,385	17,701	(3,540)	[850]	{425}	18,022	(3,604)	[865]	{433}	18,348	(3,670)	[881]	{440}
Contra Costa	12,527	12,663	12,906	13,181	13,492	(2,698)	[648]	{324}	13,801	(2,760)	[662]	{331}	14,107	(2,821)	[677]	{339}
Fresno	23,197	23,414	23,618	23,932	24,688	(4,938)	[1,185]	{593}	25,467	(5,093)	[1,222]	{611}	26,271	(5,254)	[1,261]	{630}
Kern	27,915	28,140	28,234	28,520	28,808	(5,762)	[1,383]	{691}	29,073	(5,815)	[1,395]	{698}	29,316	(5,863)	[1,407]	{704}
Los Angeles	231,695	232,893	233,777	235,386	237,314	(47,463)	[11,391]	{5,696}	239,160	(47,832)	[11,480]	{5,740}	240,927	(48,185)	[11,564]	{5,782}
Marin	5,905	5,930	5,942	5,965	6,000	(1,200)	[288]	{144}	6,033	(1,207)	[290]	{145}	6,065	(1,213)	[291]	{146}
Monterey	7,081	7,226	7,274	7,393	7,594	(1,519)	[365]	{182}	7,801	(1,560)	[374]	{187}	8,014	(1,603)	[385]	{192}
Orange	45,954	46,307	46,642	47,090	47,735	(9,547)	[2,291]	{1,146}	48,376	(9,675)	[2,322]	{1,161}	49,013	(9,803)	[2,353]	{1,176}
Placer	2,777	2,795	2,833	2,852	2,894	(579)	[139]	{69}	2,933	(587)	[141]	{70}	2,971	(594)	[143]	{71}
Riverside	49,944	50,744	51,200	51,538	52,353	(10,471)	[2,513]	{1,256}	53,152	(10,630)	[2,551]	{1,276}	53,936	(10,787)	[2,589]	{1,294}
Sacramento	15,516	16,331	16,623	16,742	16,945	(3,389)	[813]	{407}	17,137	(3,427)	[823]	{411}	17,318	(3,464)	[831]	{416}
San Bernardino	45,035	45,246	45,666	46,051	46,952	(9,390)	[2,254]	{1,127}	47,852	(9,570)	[2,297]	{1,148}	48,748	(9,750)	[2,340]	{1,170}
San Diego	36,540	36,727	36,994	37,222	37,667	(7,533)	[1,808]	{904}	38,103	(7,621)	[1,829]	{914}	38,529	(7,706)	[1,849]	{925}
San Francisco	8,871	8,936	8,981	9,060	9,195	(1,839)	[441]	{221}	9,327	(1,865)	[448]	{224}	9,456	(1,891)	[454]	{227}
San Joaquin	16,068	16,131	16,565	16,795	17,126	(3,425)	[822]	{411}	17,462	(3,492)	[838]	{419}	17,803	(3,561)	[855]	{427}
San Luis Obispo	2,672	2,679	2,735	2,769	2,804	(561)	[135]	{67}	2,838	(568)	[136]	{68}	2,869	(574)	[138]	{69}
San Mateo	7,603	7,670	7,788	7,849	8,019	(1,604)	[385]	{192}	8,189	(1,638)	[393]	{197}	8,359	(1,672)	[401]	{201}
Santa Barbara	7,685	7,725	7,800	7,869	7,952	(1,590)	[382]	{191}	8,036	(1,607)	[386]	{193}	8,120	(1,624)	[390]	{195}
Santa Clara	15,688	16,151	16,229	16,306	16,616	(3,323)	[798]	{399}	16,926	(3,385)	[812]	{406}	17,234	(3,447)	[827]	{414}
Santa Cruz	1,628	1,636	1,698	1,714	1,760	(352)	[84]	{42}	1,808	(362)	[87]	{43}	1,858	(372)	[89]	{45}
Solano	5,153	5,206	5,231	5,280	5,373	(1,075)	[258]	{129}	5,465	(1,093)	[262]	{131}	5,557	(1,111)	[267]	{133}
Sonoma	5,120	5,212	5,351	5,422	5,643	(1,129)	[271]	{135}	5,876	(1,175)	[282]	{141}	6,121	(1,224)	[294]	{147}
Ventura	9,959	10,126	10,261	10,313	10,485	(2,097)	[503]	{252}	10,658	(2,132)	[512]	{256}	10,832	(2,166)	[520]	{260}

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.