

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/6/20**

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 10/6/20 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.

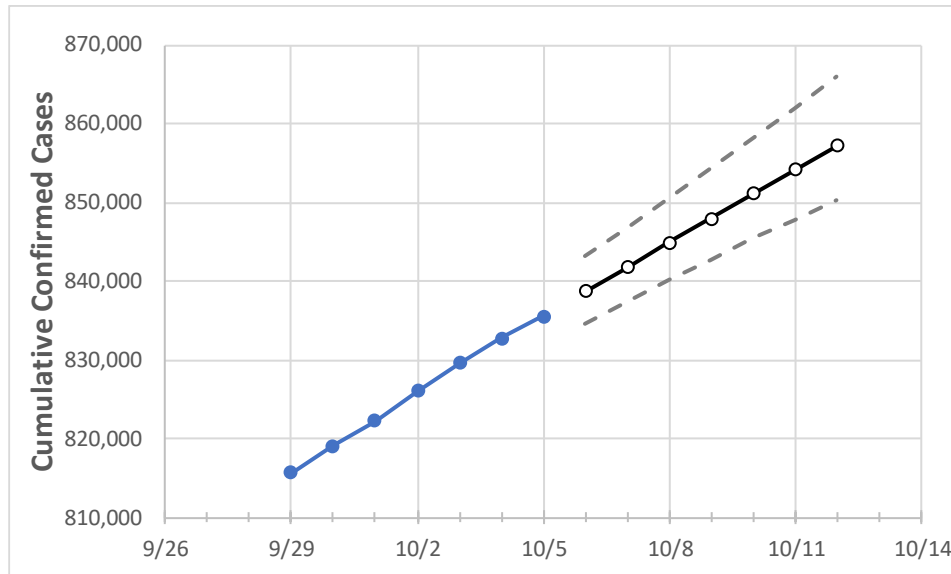
IEM's Modeling Lead

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:						
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12
California	826,013	829,521	832,713	835,507	838,637	841,755	844,862	847,959	851,045	854,122	857,188

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:						
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12
Alameda	21,508	21,621	21,708	21,746	21,811	21,875	21,938	22,000	22,062	22,123	22,182
Contra Costa	16,973	17,069	17,159	17,263	17,354	17,446	17,538	17,630	17,722	17,814	17,906
Fresno	28,796	28,855	28,975	29,065	29,151	29,237	29,323	29,409	29,494	29,579	29,664
Kern	32,184	32,343	32,443	32,491	32,546	32,600	32,652	32,704	32,755	32,805	32,854
Los Angeles	272,653	273,638	274,565	274,942	275,862	276,783	277,703	278,624	279,545	280,467	281,389
Marin	6,751	6,764	6,773	6,781	6,791	6,801	6,810	6,820	6,829	6,838	6,847
Monterey	10,181	10,219	10,312	10,359	10,413	10,468	10,523	10,579	10,634	10,690	10,747
Orange	54,118	54,357	54,640	54,760	54,938	55,118	55,299	55,482	55,666	55,851	56,038
Placer	3,628	3,638	3,648	3,684	3,694	3,703	3,713	3,722	3,730	3,739	3,747
Riverside	59,934	59,963	59,991	60,738	60,854	60,968	61,080	61,191	61,299	61,406	61,511
Sacramento	22,755	22,855	23,076	23,162	23,254	23,346	23,436	23,526	23,614	23,702	23,789
San Bernardino	55,671	56,011	56,275	56,400	56,576	56,752	56,929	57,106	57,283	57,461	57,640
San Diego	47,791	48,200	48,436	48,660	48,925	49,191	49,460	49,730	50,001	50,274	50,549
San Francisco	11,360	11,414	11,475	11,480	11,512	11,544	11,574	11,604	11,632	11,660	11,686
San Joaquin	20,485	20,513	20,541	20,569	20,595	20,619	20,643	20,666	20,688	20,709	20,730
San Luis Obispo	3,649	3,685	3,687	3,688	3,696	3,704	3,711	3,718	3,725	3,732	3,739
San Mateo	10,126	10,207	10,241	10,275	10,316	10,357	10,397	10,437	10,476	10,515	10,554
Santa Barbara	9,223	9,249	9,256	9,276	9,298	9,320	9,341	9,362	9,383	9,404	9,424
Santa Clara	21,605	21,734	21,840	21,926	22,022	22,119	22,215	22,312	22,409	22,505	22,602
Santa Cruz	2,427	2,481	2,494	2,501	2,512	2,522	2,533	2,543	2,553	2,563	2,573
Solano	6,520	6,547	6,574	6,601	6,630	6,658	6,687	6,715	6,744	6,773	6,801
Sonoma	7,668	7,752	7,861	7,940	8,010	8,083	8,158	8,235	8,314	8,396	8,480
Ventura	13,057	13,120	13,150	13,197	13,246	13,295	13,343	13,391	13,439	13,486	13,533

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:											
	10/2	10/3	10/4	10/5	10/7				10/9				10/11			
Alameda	21,508	21,621	21,708	21,746	21,875	(4,375)	[1,050]	{525}	22,000	(4,400)	[1,056]	{528}	22,123	(4,425)	[1,062]	{531}
Contra Costa	16,973	17,069	17,159	17,263	17,446	(3,489)	[837]	{419}	17,630	(3,526)	[846]	{423}	17,814	(3,563)	[855]	{428}
Fresno	28,796	28,855	28,975	29,065	29,237	(5,847)	[1,403]	{702}	29,409	(5,882)	[1,412]	{706}	29,579	(5,916)	[1,420]	{710}
Kern	32,184	32,343	32,443	32,491	32,600	(6,520)	[1,565]	{782}	32,704	(6,541)	[1,570]	{785}	32,805	(6,561)	[1,575]	{787}
Los Angeles	272,653	273,638	274,565	274,942	276,783	(55,357)	[13,286]	{6,643}	278,624	(55,725)	[13,374]	{6,687}	280,467	(56,093)	[13,462]	{6,731}
Marin	6,751	6,764	6,773	6,781	6,801	(1,360)	[326]	{163}	6,820	(1,364)	[327]	{164}	6,838	(1,368)	[328]	{164}
Monterey	10,181	10,219	10,312	10,359	10,468	(2,094)	[502]	{251}	10,579	(2,116)	[508]	{254}	10,690	(2,138)	[513]	{257}
Orange	54,118	54,357	54,640	54,760	55,118	(11,024)	[2,646]	{1,323}	55,482	(11,096)	[2,663]	{1,332}	55,851	(11,170)	[2,681]	{1,340}
Placer	3,628	3,638	3,648	3,684	3,703	(741)	[178]	{89}	3,722	(744)	[179]	{89}	3,739	(748)	[179]	{90}
Riverside	59,934	59,963	59,991	60,738	60,968	(12,194)	[2,926]	{1,463}	61,191	(12,238)	[2,937]	{1,469}	61,406	(12,281)	[2,947]	{1,474}
Sacramento	22,755	22,855	23,076	23,162	23,346	(4,669)	[1,121]	{560}	23,526	(4,705)	[1,129]	{565}	23,702	(4,740)	[1,138]	{569}
San Bernardino	55,671	56,011	56,275	56,400	56,752	(11,350)	[2,724]	{1,362}	57,106	(11,421)	[2,741]	{1,371}	57,461	(11,492)	[2,758]	{1,379}
San Diego	47,791	48,200	48,436	48,660	49,191	(9,838)	[2,361]	{1,181}	49,730	(9,946)	[2,387]	{1,194}	50,274	(10,055)	[2,413]	{1,207}
San Francisco	11,360	11,414	11,475	11,480	11,544	(2,309)	[554]	{277}	11,604	(2,321)	[557]	{278}	11,660	(2,332)	[560]	{280}
San Joaquin	20,485	20,513	20,541	20,569	20,619	(4,124)	[990]	{495}	20,666	(4,133)	[992]	{496}	20,709	(4,142)	[994]	{497}
San Luis Obispo	3,649	3,685	3,687	3,688	3,704	(741)	[178]	{89}	3,718	(744)	[178]	{89}	3,732	(746)	[179]	{90}
San Mateo	10,126	10,207	10,241	10,275	10,357	(2,071)	[497]	{249}	10,437	(2,087)	[501]	{250}	10,515	(2,103)	[505]	{252}
Santa Barbara	9,223	9,249	9,256	9,276	9,320	(1,864)	[447]	{224}	9,362	(1,872)	[449]	{225}	9,404	(1,881)	[451]	{226}
Santa Clara	21,605	21,734	21,840	21,926	22,119	(4,424)	[1,062]	{531}	22,312	(4,462)	[1,071]	{535}	22,505	(4,501)	[1,080]	{540}
Santa Cruz	2,427	2,481	2,494	2,501	2,522	(504)	[121]	{61}	2,543	(509)	[122]	{61}	2,563	(513)	[123]	{62}
Solano	6,520	6,547	6,574	6,601	6,658	(1,332)	[320]	{160}	6,715	(1,343)	[322]	{161}	6,773	(1,355)	[325]	{163}
Sonoma	7,668	7,752	7,861	7,940	8,083	(1,617)	[388]	{194}	8,235	(1,647)	[395]	{198}	8,396	(1,679)	[403]	{201}
Ventura	13,057	13,120	13,150	13,197	13,295	(2,659)	[638]	{319}	13,391	(2,678)	[643]	{321}	13,486	(2,697)	[647]	{324}

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.