

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 8/12/20**

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 8/12/20 1 p.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.

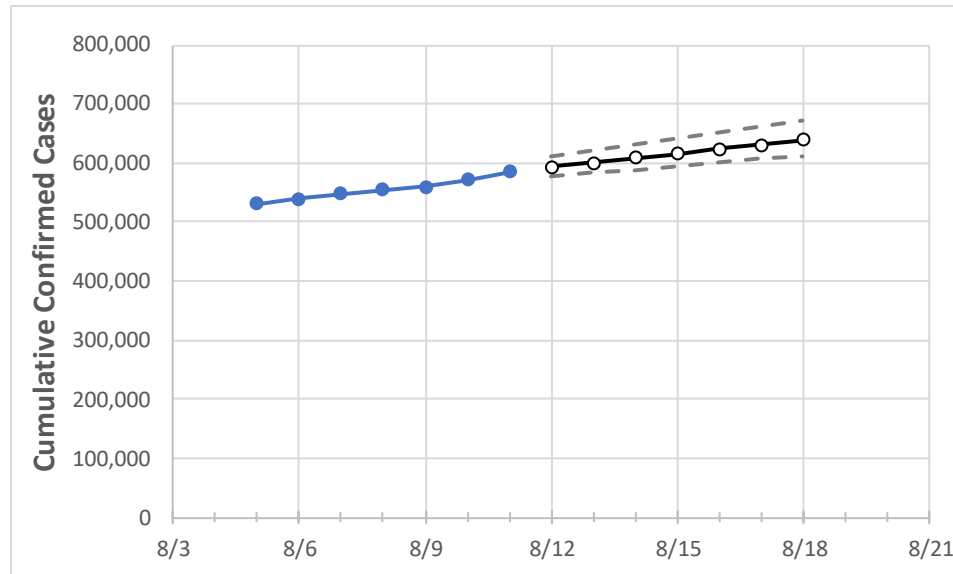
IEM's Modeling Lead

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:						
	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	8/18
California	554,022	560,236	571,110	585,181	592,851	600,529	608,212	615,900	623,594	631,292	638,996

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:						
	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	8/18
Alameda	12,933	13,199	13,218	13,664	13,830	13,998	14,168	14,340	14,514	14,691	14,869
Contra Costa	9,022	9,182	9,404	9,787	9,967	10,151	10,339	10,532	10,730	10,933	11,140
Fresno	17,290	17,568	17,846	17,978	18,265	18,552	18,840	19,129	19,418	19,708	19,998
Kern	22,626	23,583	24,440	24,995	25,572	26,166	26,776	27,404	28,050	28,714	29,397
Los Angeles	206,761	208,528	210,168	211,808	213,765	215,701	217,617	219,513	221,389	223,245	225,082
Marin	5,319	5,351	5,384	5,471	5,524	5,577	5,632	5,688	5,746	5,804	5,864
Monterey	5,253	5,349	5,446	5,494	5,571	5,649	5,727	5,805	5,885	5,964	6,045
Orange	39,076	39,641	40,527	41,578	41,870	42,156	42,435	42,709	42,976	43,238	43,494
Placer	2,186	2,282	2,319	2,377	2,418	2,460	2,503	2,546	2,591	2,636	2,683
Riverside	40,962	41,473	41,983	43,376	43,866	44,360	44,856	45,356	45,859	46,366	46,875
Sacramento	11,210	11,625	12,040	12,274	12,453	12,635	12,819	13,005	13,194	13,385	13,578
San Bernardino	35,452	35,712	36,072	37,315	37,697	38,080	38,462	38,844	39,226	39,607	39,988
San Diego	32,330	32,747	32,975	33,157	33,466	33,771	34,072	34,370	34,664	34,955	35,242
San Francisco	7,432	7,548	7,623	7,692	7,788	7,884	7,982	8,080	8,179	8,278	8,379
San Joaquin	12,490	12,677	12,864	13,870	14,029	14,189	14,349	14,510	14,672	14,834	14,997
San Luis Obispo	2,147	2,200	2,254	2,278	2,319	2,362	2,405	2,449	2,494	2,539	2,586
San Mateo	6,110	6,214	6,318	6,431	6,501	6,572	6,644	6,716	6,789	6,862	6,936
Santa Barbara	6,797	6,889	6,982	7,074	7,146	7,218	7,291	7,364	7,436	7,509	7,582
Santa Clara	11,687	11,954	12,694	12,962	13,225	13,494	13,770	14,052	14,342	14,638	14,942
Santa Cruz	1,238	1,241	1,243	1,287	1,299	1,311	1,322	1,334	1,346	1,357	1,369
Solano	4,111	4,192	4,274	4,338	4,404	4,470	4,537	4,605	4,673	4,741	4,810
Sonoma	3,556	3,670	3,712	3,753	3,829	3,906	3,986	4,068	4,152	4,238	4,326
Ventura	8,309	8,471	8,634	8,740	8,855	8,971	9,088	9,206	9,324	9,443	9,562

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:											
	8/8	8/9	8/10	8/11	8/13				8/15				8/17			
Alameda	12,933	13,199	13,218	13,664	13,998	(2,800)	[672]	{336}	14,340	(2,868)	[688]	{344}	14,691	(2,938)	[705]	{353}
Contra Costa	9,022	9,182	9,404	9,787	10,151	(2,030)	[487]	{244}	10,532	(2,106)	[506]	{253}	10,933	(2,187)	[525]	{262}
Fresno	17,290	17,568	17,846	17,978	18,552	(3,710)	[891]	{445}	19,129	(3,826)	[918]	{459}	19,708	(3,942)	[946]	{473}
Kern	22,626	23,583	24,440	24,995	26,166	(5,233)	[1,256]	{628}	27,404	(5,481)	[1,315]	{658}	28,714	(5,743)	[1,378]	{689}
Los Angeles	206,761	208,528	210,168	211,808	215,701	(43,140)	[10,354]	{5,177}	219,513	(43,903)	[10,537]	{5,268}	223,245	(44,649)	[10,716]	{5,358}
Marin	5,319	5,351	5,384	5,471	5,577	(1,115)	[268]	{134}	5,688	(1,138)	[273]	{137}	5,804	(1,161)	[279]	{139}
Monterey	5,253	5,349	5,446	5,494	5,649	(1,130)	[271]	{136}	5,805	(1,161)	[279]	{139}	5,964	(1,193)	[286]	{143}
Orange	39,076	39,641	40,527	41,578	42,156	(8,431)	[2,023]	{1,012}	42,709	(8,542)	[2,050]	{1,025}	43,238	(8,648)	[2,075]	{1,038}
Placer	2,186	2,282	2,319	2,377	2,460	(492)	[118]	{59}	2,546	(509)	[122]	{61}	2,636	(527)	[127]	{63}
Riverside	40,962	41,473	41,983	43,376	44,360	(8,872)	[2,129]	{1,065}	45,356	(9,071)	[2,177]	{1,089}	46,366	(9,273)	[2,226]	{1,113}
Sacramento	11,210	11,625	12,040	12,274	12,635	(2,527)	[606]	{303}	13,005	(2,601)	[624]	{312}	13,385	(2,677)	[642]	{321}
San Bernardino	35,452	35,712	36,072	37,315	38,080	(7,616)	[1,828]	{914}	38,844	(7,769)	[1,865]	{932}	39,607	(7,921)	[1,901]	{951}
San Diego	32,330	32,747	32,975	33,157	33,771	(6,754)	[1,621]	{811}	34,370	(6,874)	[1,650]	{825}	34,955	(6,991)	[1,678]	{839}
San Francisco	7,432	7,548	7,623	7,692	7,884	(1,577)	[378]	{189}	8,080	(1,616)	[388]	{194}	8,278	(1,656)	[397]	{199}
San Joaquin	12,490	12,677	12,864	13,870	14,189	(2,838)	[681]	{341}	14,510	(2,902)	[696]	{348}	14,834	(2,967)	[712]	{356}
San Luis Obispo	2,147	2,200	2,254	2,278	2,362	(472)	[113]	{57}	2,449	(490)	[118]	{59}	2,539	(508)	[122]	{61}
San Mateo	6,110	6,214	6,318	6,431	6,572	(1,314)	[315]	{158}	6,716	(1,343)	[322]	{161}	6,862	(1,372)	[329]	{165}
Santa Barbara	6,797	6,889	6,982	7,074	7,218	(1,444)	[346]	{173}	7,364	(1,473)	[353]	{177}	7,509	(1,502)	[360]	{180}
Santa Clara	11,687	11,954	12,694	12,962	13,494	(2,699)	[648]	{324}	14,052	(2,810)	[675]	{337}	14,638	(2,928)	[703]	{351}
Santa Cruz	1,238	1,241	1,243	1,287	1,311	(262)	[63]	{31}	1,334	(267)	[64]	{32}	1,357	(271)	[65]	{33}
Solano	4,111	4,192	4,274	4,338	4,470	(894)	[215]	{107}	4,605	(921)	[221]	{111}	4,741	(948)	[228]	{114}
Sonoma	3,556	3,670	3,712	3,753	3,906	(781)	[188]	{94}	4,068	(814)	[195]	{98}	4,238	(848)	[203]	{102}
Ventura	8,309	8,471	8,634	8,740	8,971	(1,794)	[431]	{215}	9,206	(1,841)	[442]	{221}	9,443	(1,889)	[453]	{227}

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.