

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

Date: 8/4/20

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 8/4/20 12 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.

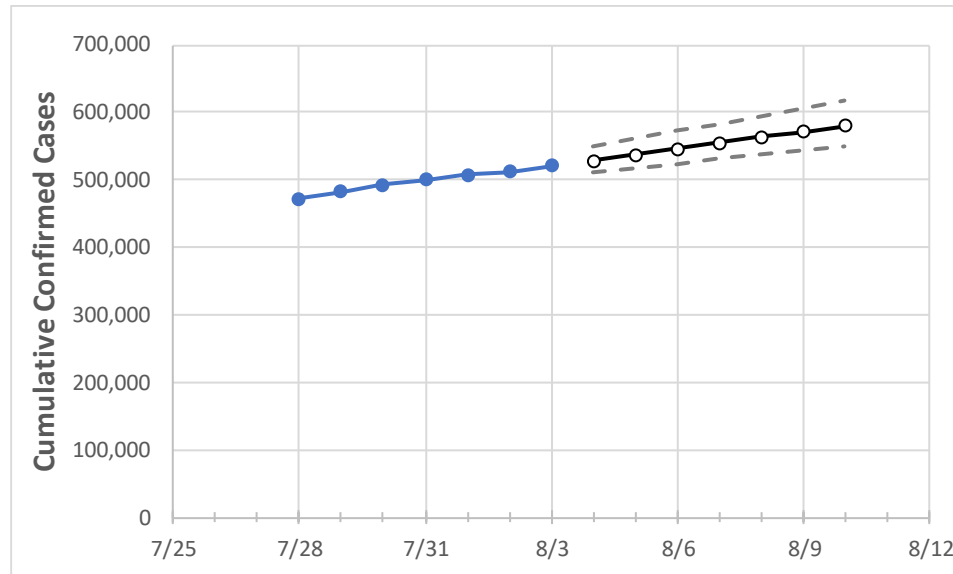
IEM's Modeling Lead

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:							
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	
California	500,421	507,711	512,525	520,357	528,891	537,426	545,964	554,503	563,044	571,586	580,130	

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:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Alameda	11,308	11,484	11,524	11,846	11,995	12,145	12,296	12,447	12,600	12,753	12,907
Contra Costa	7,670	7,806	7,966	8,033	8,167	8,302	8,437	8,574	8,711	8,849	8,987
Fresno	14,439	15,083	15,421	15,759	16,132	16,513	16,903	17,302	17,709	18,126	18,551
Kern	19,335	19,882	20,545	20,651	21,035	21,666	22,354	22,995	23,639	24,372	25,041
Los Angeles	188,481	190,693	192,167	193,788	195,988	198,170	200,336	202,485	204,618	206,735	208,835
Marin	4,987	5,030	5,072	5,115	5,205	5,300	5,399	5,502	5,610	5,724	5,842
Monterey	4,542	4,669	4,797	4,924	5,038	5,156	5,278	5,403	5,533	5,667	5,806
Orange	36,196	36,833	37,391	37,813	38,240	38,661	39,074	39,481	39,881	40,275	40,663
Placer	1,876	1,912	1,925	1,938	1,971	2,005	2,038	2,073	2,107	2,142	2,178
Riverside	37,011	37,480	37,980	38,131	38,567	39,000	39,429	39,855	40,276	40,695	41,109
Sacramento	9,820	10,016	10,067	10,122	10,263	10,402	10,539	10,674	10,807	10,939	11,068
San Bernardino	32,230	32,696	32,980	33,432	33,968	34,510	35,058	35,613	36,174	36,741	37,315
San Diego	29,048	29,577	29,883	30,226	30,629	31,030	31,431	31,830	32,228	32,625	33,020
San Francisco	6,575	6,723	6,811	6,989	7,127	7,271	7,419	7,573	7,733	7,899	8,070
San Joaquin	11,483	11,617	11,751	11,885	12,070	12,255	12,440	12,624	12,808	12,992	13,175
San Luis Obispo	1,783	1,823	1,862	1,902	1,942	1,983	2,025	2,068	2,111	2,156	2,201
San Mateo	5,469	5,544	5,644	5,744	5,834	5,926	6,020	6,116	6,214	6,313	6,414
Santa Barbara	6,167	6,266	6,365	6,464	6,562	6,662	6,763	6,866	6,970	7,077	7,185
Santa Clara	9,913	10,321	10,626	10,794	11,022	11,256	11,495	11,738	11,987	12,242	12,501
Santa Cruz	1,109	1,152	1,152	1,152	1,190	1,230	1,273	1,318	1,367	1,419	1,475
Solano	3,611	3,648	3,684	3,721	3,781	3,841	3,902	3,962	4,022	4,082	4,143
Sonoma	2,842	2,944	3,055	3,113	3,177	3,243	3,310	3,380	3,452	3,525	3,601
Ventura	7,344	7,522	7,699	7,877	8,037	8,200	8,366	8,536	8,708	8,884	9,063

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:											
	7/31	8/1	8/2	8/3	8/5				8/7				8/9			
Alameda	11,308	11,484	11,524	11,846	12,145	(2,429)	[583]	{291}	12,447	(2,489)	[597]	{299}	12,753	(2,551)	[612]	{306}
Contra Costa	7,670	7,806	7,966	8,033	8,302	(1,660)	[398]	{199}	8,574	(1,715)	[412]	{206}	8,849	(1,770)	[425]	{212}
Fresno	14,439	15,083	15,421	15,759	16,513	(3,303)	[793]	{396}	17,302	(3,460)	[830]	{415}	18,126	(3,625)	[870]	{435}
Kern	19,335	19,882	20,545	20,651	21,666	(4,333)	[1,040]	{520}	22,995	(4,599)	[1,104]	{552}	24,372	(4,874)	[1,170]	{585}
Los Angeles	188,481	190,693	192,167	193,788	198,170	(39,634)	[9,512]	{4,756}	202,485	(40,497)	[9,719]	{4,860}	206,735	(41,347)	[9,923]	{4,962}
Marin	4,987	5,030	5,072	5,115	5,300	(1,060)	[254]	{127}	5,502	(1,100)	[264]	{132}	5,724	(1,145)	[275]	{137}
Monterey	4,542	4,669	4,797	4,924	5,156	(1,031)	[247]	{124}	5,403	(1,081)	[259]	{130}	5,667	(1,133)	[272]	{136}
Orange	36,196	36,833	37,391	37,813	38,661	(7,732)	[1,856]	{928}	39,481	(7,896)	[1,895]	{948}	40,275	(8,055)	[1,933]	{967}
Placer	1,876	1,912	1,925	1,938	2,005	(401)	[96]	{48}	2,073	(415)	[99]	{50}	2,142	(428)	[103]	{51}
Riverside	37,011	37,480	37,980	38,131	39,000	(7,800)	[1,872]	{936}	39,855	(7,971)	[1,913]	{957}	40,695	(8,139)	[1,953]	{977}
Sacramento	9,820	10,016	10,067	10,122	10,402	(2,080)	[499]	{250}	10,674	(2,135)	[512]	{256}	10,939	(2,188)	[525]	{263}
San Bernardino	32,230	32,696	32,980	33,432	34,510	(6,902)	[1,656]	{828}	35,613	(7,123)	[1,709]	{855}	36,741	(7,348)	[1,764]	{882}
San Diego	29,048	29,577	29,883	30,226	31,030	(6,206)	[1,489]	{745}	31,830	(6,366)	[1,528]	{764}	32,625	(6,525)	[1,566]	{783}
San Francisco	6,575	6,723	6,811	6,989	7,271	(1,454)	[349]	{174}	7,573	(1,515)	[364]	{182}	7,899	(1,580)	[379]	{190}
San Joaquin	11,483	11,617	11,751	11,885	12,255	(2,451)	[588]	{294}	12,624	(2,525)	[606]	{303}	12,992	(2,598)	[624]	{312}
San Luis Obispo	1,783	1,823	1,862	1,902	1,983	(397)	[95]	{48}	2,068	(414)	[99]	{50}	2,156	(431)	[103]	{52}
San Mateo	5,469	5,544	5,644	5,744	5,926	(1,185)	[284]	{142}	6,116	(1,223)	[294]	{147}	6,313	(1,263)	[303]	{152}
Santa Barbara	6,167	6,266	6,365	6,464	6,662	(1,332)	[320]	{160}	6,866	(1,373)	[330]	{165}	7,077	(1,415)	[340]	{170}
Santa Clara	9,913	10,321	10,626	10,794	11,256	(2,251)	[540]	{270}	11,738	(2,348)	[563]	{282}	12,242	(2,448)	[588]	{294}
Santa Cruz	1,109	1,152	1,152	1,152	1,230	(246)	[59]	{30}	1,318	(264)	[63]	{32}	1,419	(284)	[68]	{34}
Solano	3,611	3,648	3,684	3,721	3,841	(768)	[184]	{92}	3,962	(792)	[190]	{95}	4,082	(816)	[196]	{98}
Sonoma	2,842	2,944	3,055	3,113	3,243	(649)	[156]	{78}	3,380	(676)	[162]	{81}	3,525	(705)	[169]	{85}
Ventura	7,344	7,522	7,699	7,877	8,200	(1,640)	[394]	{197}	8,536	(1,707)	[410]	{205}	8,884	(1,777)	[426]	{213}

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.