

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

**Date: 8/6/20**

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

The projections shown in this document are based on data pulled in as of 8/6/20 11 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.**

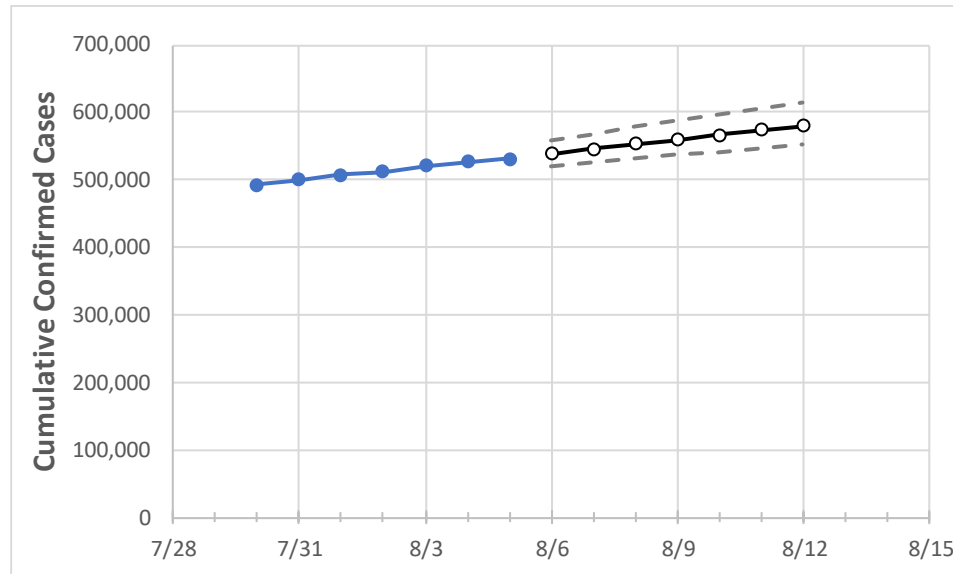
### **IEM's Modeling Lead**

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:							
	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	
California	512,525	520,357	526,161	531,891	539,015	546,071	553,058	559,977	566,828	573,612	580,328	

*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:						
	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12
Alameda	11,524	11,846	11,909	12,136	12,270	12,405	12,541	12,677	12,813	12,950	13,087
Contra Costa	7,966	8,033	8,176	8,324	8,444	8,563	8,682	8,801	8,920	9,038	9,157
Fresno	15,421	15,759	15,945	16,272	16,589	16,910	17,233	17,560	17,890	18,223	18,559
Kern	20,545	20,651	21,228	21,433	21,643	22,163	22,695	23,187	23,690	24,181	24,725
Los Angeles	192,167	193,788	195,614	197,912	199,856	201,773	203,664	205,528	207,366	209,178	210,966
Marin	5,072	5,115	5,180	5,190	5,228	5,274	5,321	5,365	5,405	5,451	5,496
Monterey	4,797	4,924	4,966	5,049	5,140	5,233	5,328	5,424	5,522	5,622	5,723
Orange	37,391	37,813	38,066	38,131	38,384	38,626	38,858	39,079	39,291	39,494	39,688
Placer	1,925	1,938	1,953	1,998	2,024	2,050	2,076	2,102	2,128	2,153	2,178
Riverside	37,980	38,131	38,487	38,977	39,318	39,652	39,978	40,297	40,608	40,913	41,211
Sacramento	10,067	10,122	10,174	10,244	10,327	10,407	10,483	10,555	10,624	10,690	10,753
San Bernardino	32,980	33,432	34,017	34,237	34,647	35,055	35,461	35,864	36,265	36,664	37,061
San Diego	29,883	30,226	30,516	30,864	31,193	31,518	31,837	32,152	32,462	32,768	33,069
San Francisco	6,811	6,989	7,035	7,081	7,179	7,279	7,379	7,482	7,585	7,690	7,797
San Joaquin	11,751	11,885	11,958	12,034	12,149	12,262	12,372	12,478	12,583	12,684	12,783
San Luis Obispo	1,862	1,902	1,926	1,970	2,005	2,039	2,074	2,110	2,145	2,181	2,218
San Mateo	5,644	5,744	5,751	5,758	5,798	5,837	5,875	5,913	5,949	5,984	6,018
Santa Barbara	6,365	6,464	6,526	6,586	6,659	6,732	6,805	6,877	6,949	7,022	7,094
Santa Clara	10,626	10,794	11,030	11,128	11,329	11,533	11,740	11,949	12,161	12,376	12,594
Santa Cruz	1,167	1,181	1,196	1,196	1,222	1,249	1,277	1,307	1,337	1,369	1,402
Solano	3,684	3,721	3,806	3,884	3,939	3,994	4,049	4,103	4,158	4,212	4,266
Sonoma	3,055	3,113	3,161	3,208	3,264	3,322	3,380	3,440	3,500	3,562	3,625
Ventura	7,699	7,877	7,915	7,953	8,062	8,172	8,282	8,393	8,504	8,615	8,727

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:											
	8/2	8/3	8/4	8/5	8/7				8/9				8/11			
Alameda	11,524	11,846	11,909	12,136	12,405	(2,481)	[595]	{298}	12,677	(2,535)	[608]	{304}	12,950	(2,590)	[622]	{311}
Contra Costa	7,966	8,033	8,176	8,324	8,563	(1,713)	[411]	{206}	8,801	(1,760)	[422]	{211}	9,038	(1,808)	[434]	{217}
Fresno	15,421	15,759	15,945	16,272	16,910	(3,382)	[812]	{406}	17,560	(3,512)	[843]	{421}	18,223	(3,645)	[875]	{437}
Kern	20,545	20,651	21,228	21,433	22,163	(4,433)	[1,064]	{532}	23,187	(4,637)	[1,113]	{556}	24,181	(4,836)	[1,161]	{580}
Los Angeles	192,167	193,788	195,614	197,912	201,773	(40,355)	[9,685]	{4,843}	205,528	(41,106)	[9,865]	{4,933}	209,178	(41,836)	[10,041]	{5,020}
Marin	5,072	5,115	5,180	5,190	5,274	(1,055)	[253]	{127}	5,365	(1,073)	[258]	{129}	5,451	(1,090)	[262]	{131}
Monterey	4,797	4,924	4,966	5,049	5,233	(1,047)	[251]	{126}	5,424	(1,085)	[260]	{130}	5,622	(1,124)	[270]	{135}
Orange	37,391	37,813	38,066	38,131	38,626	(7,725)	[1,854]	{927}	39,079	(7,816)	[1,876]	{938}	39,494	(7,899)	[1,896]	{948}
Placer	1,925	1,938	1,953	1,998	2,050	(410)	[98]	{49}	2,102	(420)	[101]	{50}	2,153	(431)	[103]	{52}
Riverside	37,980	38,131	38,487	38,977	39,652	(7,930)	[1,903]	{952}	40,297	(8,059)	[1,934]	{967}	40,913	(8,183)	[1,964]	{982}
Sacramento	10,067	10,122	10,174	10,244	10,407	(2,081)	[500]	{250}	10,555	(2,111)	[507]	{253}	10,690	(2,138)	[513]	{257}
San Bernardino	32,980	33,432	34,017	34,237	35,055	(7,011)	[1,683]	{841}	35,864	(7,173)	[1,721]	{861}	36,664	(7,333)	[1,760]	{880}
San Diego	29,883	30,226	30,516	30,864	31,518	(6,304)	[1,513]	{756}	32,152	(6,430)	[1,543]	{772}	32,768	(6,554)	[1,573]	{786}
San Francisco	6,811	6,989	7,035	7,081	7,279	(1,456)	[349]	{175}	7,482	(1,496)	[359]	{180}	7,690	(1,538)	[369]	{185}
San Joaquin	11,751	11,885	11,958	12,034	12,262	(2,452)	[589]	{294}	12,478	(2,496)	[599]	{299}	12,684	(2,537)	[609]	{304}
San Luis Obispo	1,862	1,902	1,926	1,970	2,039	(408)	[98]	{49}	2,110	(422)	[101]	{51}	2,181	(436)	[105]	{52}
San Mateo	5,644	5,744	5,751	5,758	5,837	(1,167)	[280]	{140}	5,913	(1,183)	[284]	{142}	5,984	(1,197)	[287]	{144}
Santa Barbara	6,365	6,464	6,526	6,586	6,732	(1,346)	[323]	{162}	6,877	(1,375)	[330]	{165}	7,022	(1,404)	[337]	{169}
Santa Clara	10,626	10,794	11,030	11,128	11,533	(2,307)	[554]	{277}	11,949	(2,390)	[574]	{287}	12,376	(2,475)	[594]	{297}
Santa Cruz	1,167	1,181	1,196	1,196	1,249	(250)	[60]	{30}	1,307	(261)	[63]	{31}	1,369	(274)	[66]	{33}
Solano	3,684	3,721	3,806	3,884	3,994	(799)	[192]	{96}	4,103	(821)	[197]	{98}	4,212	(842)	[202]	{101}
Sonoma	3,055	3,113	3,161	3,208	3,322	(664)	[159]	{80}	3,440	(688)	[165]	{83}	3,562	(712)	[171]	{85}
Ventura	7,699	7,877	7,915	7,953	8,172	(1,634)	[392]	{196}	8,393	(1,679)	[403]	{201}	8,615	(1,723)	[414]	{207}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.