

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

**Date: 8/4/21**

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 8/4/21 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.**

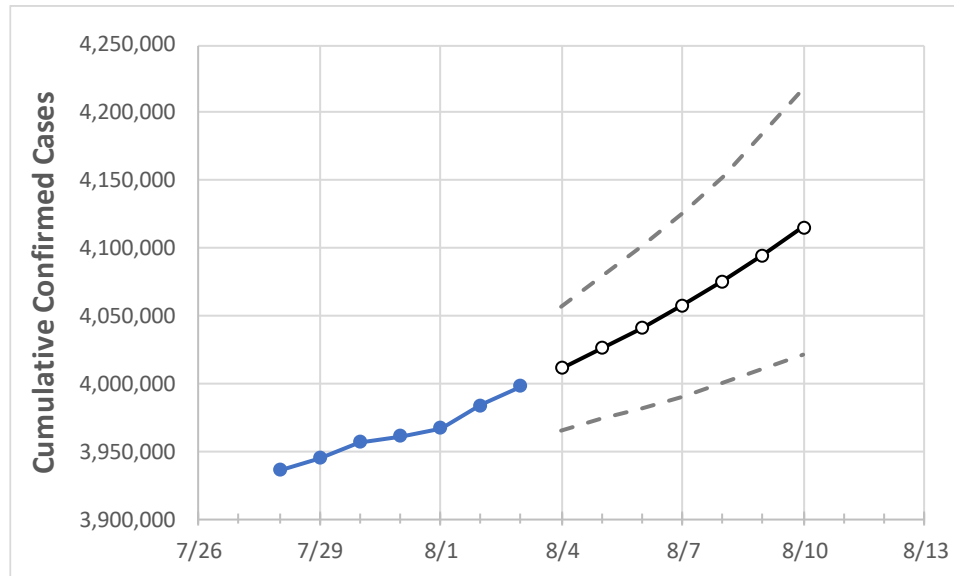
### **IEM's Modeling Lead**

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:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
California	3,961,190	3,966,943	3,983,926	3,997,767	4,011,188	4,025,657	4,041,149	4,057,962	4,075,694	4,094,766	4,115,549

*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 10%, and are often within 5%, 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	96,689	97,121	97,523	97,925	98,396	98,904	99,441	99,989	100,579	101,198	101,853
Contra Costa	77,271	77,708	77,866	78,084	78,526	78,996	79,490	80,009	80,552	81,131	81,731
Fresno	104,872	105,106	105,339	105,471	105,708	105,966	106,240	106,537	106,850	107,185	107,543
Kern	113,414	113,612	113,810	114,079	114,328	114,593	114,879	115,191	115,525	115,886	116,267
Lake	4,297	4,327	4,356	4,375	4,436	4,498	4,566	4,637	4,714	4,796	4,881
Los Angeles	1,300,313	1,303,343	1,305,704	1,307,970	1,311,152	1,314,427	1,317,802	1,321,247	1,324,778	1,328,373	1,332,095
Marin	14,920	14,958	14,982	15,039	15,090	15,144	15,201	15,260	15,322	15,389	15,458
Monterey	44,546	44,568	44,591	44,651	44,694	44,739	44,786	44,836	44,888	44,943	45,002
Orange	283,129	283,831	284,534	285,479	286,375	287,334	288,353	289,429	290,572	291,795	293,085
Placer	25,305	25,385	25,464	25,559	25,676	25,798	25,924	26,058	26,201	26,354	26,508
Riverside	308,770	308,993	309,217	311,242	312,085	312,980	313,927	314,959	316,037	317,217	318,475
Sacramento	116,197	116,661	117,126	117,543	118,095	118,677	119,291	119,937	120,597	121,298	122,027
San Bernardino	307,197	307,624	308,052	308,880	309,549	310,246	311,009	311,833	312,711	313,640	314,641
San Diego	297,226	298,002	299,021	300,189	301,470	302,845	304,334	305,900	307,556	309,347	311,303
San Francisco	40,478	40,544	41,432	41,553	41,883	42,231	42,592	42,990	43,440	43,922	44,452
San Joaquin	77,169	77,253	77,338	77,447	77,546	77,645	77,745	77,845	77,947	78,046	78,145
San Luis Obispo	22,045	22,064	22,083	22,356	22,418	22,484	22,554	22,634	22,718	22,805	22,903
San Mateo	44,760	44,898	45,036	45,154	45,309	45,472	45,643	45,822	46,010	46,206	46,414
Santa Barbara	35,812	35,882	35,953	36,740	36,959	37,209	37,499	37,843	38,241	38,715	39,264
Santa Clara	123,641	123,878	124,115	124,115	124,443	124,787	125,144	125,521	125,914	126,327	126,765
Santa Cruz	16,698	16,738	16,779	16,779	16,829	16,885	16,945	17,010	17,081	17,160	17,244
Solano	36,086	36,167	36,249	36,249	36,391	36,539	36,690	36,848	37,012	37,186	37,366
Sonoma	32,880	32,978	33,076	33,373	33,529	33,693	33,867	34,050	34,245	34,454	34,677
Ventura	84,019	84,170	84,320	84,320	84,528	84,750	84,986	85,240	85,508	85,797	86,104

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	96,689	97,121	97,523	97,925	98,904	(19,781)	[4,747]	{2,374}	99,989	(19,998)	[4,799]	{2,400}	101,198	(20,240)	[4,858]	{2,429}
Contra Costa	77,271	77,708	77,866	78,084	78,996	(15,799)	[3,792]	{1,896}	80,009	(16,002)	[3,840]	{1,920}	81,131	(16,226)	[3,894]	{1,947}
Fresno	104,872	105,106	105,339	105,471	105,966	(21,193)	[5,086]	{2,543}	106,537	(21,307)	[5,114]	{2,557}	107,185	(21,437)	[5,145]	{2,572}
Kern	113,414	113,612	113,810	114,079	114,593	(22,919)	[5,500]	{2,750}	115,191	(23,038)	[5,529]	{2,765}	115,886	(23,177)	[5,563]	{2,781}
Lake	4,297	4,327	4,356	4,375	4,498	(900)	[216]	{108}	4,637	(927)	[223]	{111}	4,796	(959)	[230]	{115}
Los Angeles	1,300,313	1,303,343	1,305,704	1,307,970	1,314,427	(262,885)	[63,093]	{31,546}	1,321,247	(264,249)	[63,420]	{31,710}	1,328,373	(265,675)	[63,762]	{31,881}
Marin	14,920	14,958	14,982	15,039	15,144	(3,029)	[727]	{363}	15,260	(3,052)	[732]	{366}	15,389	(3,078)	[739]	{369}
Monterey	44,546	44,568	44,591	44,651	44,739	(8,948)	[2,147]	{1,074}	44,836	(8,967)	[2,152]	{1,076}	44,943	(8,989)	[2,157]	{1,079}
Orange	283,129	283,831	284,534	285,479	287,334	(57,467)	[13,792]	{6,896}	289,429	(57,886)	[13,893]	{6,946}	291,795	(58,359)	[14,006]	{7,003}
Placer	25,305	25,385	25,464	25,559	25,798	(5,160)	[1,238]	{619}	26,058	(5,212)	[1,251]	{625}	26,354	(5,271)	[1,265]	{632}
Riverside	308,770	308,993	309,217	311,242	312,980	(62,596)	[15,023]	{7,512}	314,959	(62,992)	[15,118]	{7,559}	317,217	(63,443)	[15,226]	{7,613}
Sacramento	116,197	116,661	117,126	117,543	118,677	(23,735)	[5,697]	{2,848}	119,937	(23,987)	[5,757]	{2,878}	121,298	(24,260)	[5,822]	{2,911}
San Bernardino	307,197	307,624	308,052	308,880	310,246	(62,049)	[14,892]	{7,446}	311,833	(62,367)	[14,968]	{7,484}	313,640	(62,728)	[15,055]	{7,527}
San Diego	297,226	298,002	299,021	300,189	302,845	(60,569)	[14,537]	{7,268}	305,900	(61,180)	[14,683]	{7,342}	309,347	(61,869)	[14,849]	{7,424}
San Francisco	40,478	40,544	41,432	41,553	42,231	(8,446)	[2,027]	{1,014}	42,990	(8,598)	[2,064]	{1,032}	43,922	(8,784)	[2,108]	{1,054}
San Joaquin	77,169	77,253	77,338	77,447	77,645	(15,529)	[3,727]	{1,863}	77,845	(15,569)	[3,737]	{1,868}	78,046	(15,609)	[3,746]	{1,873}
San Luis Obispo	22,045	22,064	22,083	22,356	22,484	(4,497)	[1,079]	{540}	22,634	(4,527)	[1,086]	{543}	22,805	(4,561)	[1,095]	{547}
San Mateo	44,760	44,898	45,036	45,154	45,472	(9,094)	[2,183]	{1,091}	45,822	(9,164)	[2,199]	{1,100}	46,206	(9,241)	[2,218]	{1,109}
Santa Barbara	35,812	35,882	35,953	36,740	37,209	(7,442)	[1,786]	{893}	37,843	(7,569)	[1,816]	{908}	38,715	(7,743)	[1,858]	{929}
Santa Clara	123,641	123,878	124,115	124,115	124,787	(24,957)	[5,990]	{2,995}	125,521	(25,104)	[6,025]	{3,013}	126,327	(25,265)	[6,064]	{3,032}
Santa Cruz	16,698	16,738	16,779	16,779	16,885	(3,377)	[810]	{405}	17,010	(3,402)	[816]	{408}	17,160	(3,432)	[824]	{412}
Solano	36,086	36,167	36,249	36,249	36,539	(7,308)	[1,754]	{877}	36,848	(7,370)	[1,769]	{884}	37,186	(7,437)	[1,785]	{892}
Sonoma	32,880	32,978	33,076	33,373	33,693	(6,739)	[1,617]	{809}	34,050	(6,810)	[1,634]	{817}	34,454	(6,891)	[1,654]	{827}
Ventura	84,019	84,170	84,320	84,320	84,750	(16,950)	[4,068]	{2,034}	85,240	(17,048)	[4,092]	{2,046}	85,797	(17,159)	[4,118]	{2,059}

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.