

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 8/16/21**

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 8/16/21 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.

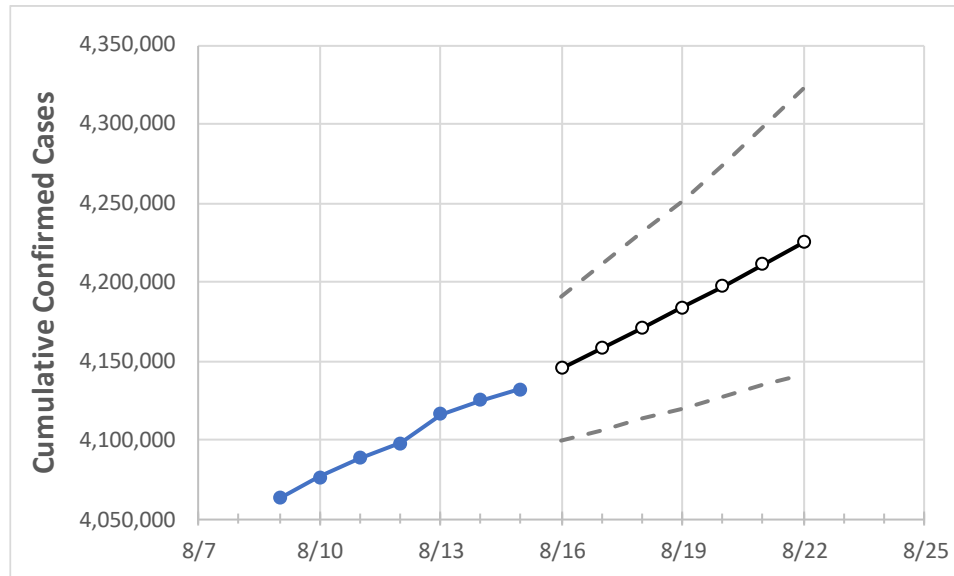
IEM's Modeling Lead

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:							
	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	
California	4,097,958	4,116,121	4,124,955	4,132,332	4,145,131	4,157,990	4,170,844	4,184,018	4,197,191	4,210,989	4,224,946	

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:						
	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22
Alameda	100,772	101,160	101,473	101,876	102,241	102,597	102,960	103,333	103,699	104,089	104,471
Contra Costa	81,017	81,406	81,823	82,150	82,506	82,865	83,233	83,610	83,980	84,356	84,742
Fresno	107,773	108,193	108,638	109,056	109,456	109,876	110,317	110,781	111,265	111,778	112,326
Kern	116,731	117,101	117,101	117,101	117,502	117,921	118,353	118,815	119,301	119,795	120,305
Lake	4,713	4,774	4,811	4,850	4,892	4,932	4,972	5,016	5,060	5,102	5,145
Los Angeles	1,339,138	1,342,839	1,347,023	1,350,370	1,354,193	1,358,080	1,362,021	1,366,083	1,370,234	1,374,457	1,378,732
Marin	15,478	15,554	15,581	15,611	15,662	15,715	15,768	15,819	15,874	15,930	15,986
Monterey	45,210	45,293	45,293	45,293	45,385	45,486	45,593	45,709	45,828	45,953	46,091
Orange	291,792	292,833	292,833	292,833	293,566	294,340	295,145	295,921	296,718	297,510	298,329
Placer	26,905	26,946	26,987	27,115	27,245	27,383	27,525	27,674	27,819	27,978	28,133
Riverside	318,774	319,733	319,733	319,733	320,911	322,122	323,434	324,843	326,279	327,784	329,384
Sacramento	121,797	122,403	122,868	123,438	123,988	124,560	125,135	125,730	126,323	126,950	127,556
San Bernardino	315,189	316,253	316,253	316,253	317,488	318,809	320,211	321,781	323,494	325,290	327,209
San Diego	310,596	312,294	313,589	314,247	315,557	316,881	318,216	319,605	321,008	322,431	323,863
San Francisco	43,555	43,774	44,196	44,353	44,571	44,789	45,007	45,238	45,457	45,673	45,895
San Joaquin	79,641	79,945	80,232	80,585	80,941	81,321	81,734	82,166	82,624	83,118	83,622
San Luis Obispo	23,226	23,359	23,359	23,359	23,512	23,689	23,890	24,093	24,328	24,576	24,843
San Mateo	46,300	46,435	46,660	46,792	46,944	47,098	47,254	47,410	47,571	47,735	47,903
Santa Barbara	36,969	37,133	37,133	37,133	37,304	37,486	37,677	37,882	38,103	38,331	38,585
Santa Clara	127,094	127,446	127,446	127,446	127,804	128,171	128,544	128,930	129,328	129,736	130,151
Santa Cruz	17,272	17,302	17,332	17,384	17,451	17,520	17,594	17,671	17,750	17,834	17,926
Solano	37,507	37,664	37,664	37,664	37,795	37,925	38,062	38,199	38,341	38,483	38,625
Sonoma	34,394	34,544	34,686	34,686	34,829	34,967	35,112	35,257	35,405	35,552	35,708
Ventura	86,151	86,440	86,505	86,569	86,755	86,944	87,130	87,320	87,510	87,705	87,896

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:											
	8/12	8/13	8/14	8/15	8/17				8/19				8/21			
Alameda	100,772	101,160	101,473	101,876	102,597	(20,519)	[4,925]	{2,462}	103,333	(20,667)	[4,960]	{2,480}	104,089	(20,818)	[4,996]	{2,498}
Contra Costa	81,017	81,406	81,823	82,150	82,865	(16,573)	[3,978]	{1,989}	83,610	(16,722)	[4,013]	{2,007}	84,356	(16,871)	[4,049]	{2,025}
Fresno	107,773	108,193	108,638	109,056	109,876	(21,975)	[5,274]	{2,637}	110,781	(22,156)	[5,318]	{2,659}	111,778	(22,356)	[5,365]	{2,683}
Kern	116,731	117,101	117,101	117,101	117,921	(23,584)	[5,660]	{2,830}	118,815	(23,763)	[5,703]	{2,852}	119,795	(23,959)	[5,750]	{2,875}
Lake	4,713	4,774	4,811	4,850	4,932	(986)	[237]	{118}	5,016	(1,003)	[241]	{120}	5,102	(1,020)	[245]	{122}
Los Angeles	1,339,138	1,342,839	1,347,023	1,350,370	1,358,080	(271,616)	[65,188]	{32,594}	1,366,083	(273,217)	[65,572]	{32,786}	1,374,457	(274,891)	[65,974]	{32,987}
Marin	15,478	15,554	15,581	15,611	15,715	(3,143)	[754]	{377}	15,819	(3,164)	[759]	{380}	15,930	(3,186)	[765]	{382}
Monterey	45,210	45,293	45,293	45,293	45,486	(9,097)	[2,183]	{1,092}	45,709	(9,142)	[2,194]	{1,097}	45,953	(9,191)	[2,206]	{1,103}
Orange	291,792	292,833	292,833	292,833	294,340	(58,868)	[14,128]	{7,064}	295,921	(59,184)	[14,204]	{7,102}	297,510	(59,502)	[14,280]	{7,140}
Placer	26,905	26,946	26,987	27,115	27,383	(5,477)	[1,314]	{657}	27,674	(5,535)	[1,328]	{664}	27,978	(5,596)	[1,343]	{671}
Riverside	318,774	319,733	319,733	319,733	322,122	(64,424)	[15,462]	{7,731}	324,843	(64,969)	[15,592]	{7,796}	327,784	(65,557)	[15,734]	{7,867}
Sacramento	121,797	122,403	122,868	123,438	124,560	(24,912)	[5,979]	{2,989}	125,730	(25,146)	[6,035]	{3,018}	126,950	(25,390)	[6,094]	{3,047}
San Bernardino	315,189	316,253	316,253	316,253	318,809	(63,762)	[15,303]	{7,651}	321,781	(64,356)	[15,445]	{7,723}	325,290	(65,058)	[15,614]	{7,807}
San Diego	310,596	312,294	313,589	314,247	316,881	(63,376)	[15,210]	{7,605}	319,605	(63,921)	[15,341]	{7,671}	322,431	(64,486)	[15,477]	{7,738}
San Francisco	43,555	43,774	44,196	44,353	44,789	(8,958)	[2,150]	{1,075}	45,238	(9,048)	[2,171]	{1,086}	45,673	(9,135)	[2,192]	{1,096}
San Joaquin	79,641	79,945	80,232	80,585	81,321	(16,264)	[3,903]	{1,952}	82,166	(16,433)	[3,944]	{1,972}	83,118	(16,624)	[3,990]	{1,995}
San Luis Obispo	23,226	23,359	23,359	23,359	23,689	(4,738)	[1,137]	{569}	24,093	(4,819)	[1,156]	{578}	24,576	(4,915)	[1,180]	{590}
San Mateo	46,300	46,435	46,660	46,792	47,098	(9,420)	[2,261]	{1,130}	47,410	(9,482)	[2,276]	{1,138}	47,735	(9,547)	[2,291]	{1,146}
Santa Barbara	36,969	37,133	37,133	37,133	37,486	(7,497)	[1,799]	{900}	37,882	(7,576)	[1,818]	{909}	38,331	(7,666)	[1,840]	{920}
Santa Clara	127,094	127,446	127,446	127,446	128,171	(25,634)	[6,152]	{3,076}	128,930	(25,786)	[6,189]	{3,094}	129,736	(25,947)	[6,227]	{3,114}
Santa Cruz	17,272	17,302	17,332	17,384	17,520	(3,504)	[841]	{420}	17,671	(3,534)	[848]	{424}	17,834	(3,567)	[856]	{428}
Solano	37,507	37,664	37,664	37,664	37,925	(7,585)	[1,820]	{910}	38,199	(7,640)	[1,834]	{917}	38,483	(7,697)	[1,847]	{924}
Sonoma	34,394	34,544	34,686	34,686	34,967	(6,993)	[1,678]	{839}	35,257	(7,051)	[1,692]	{846}	35,552	(7,110)	[1,706]	{853}
Ventura	86,151	86,440	86,505	86,569	86,944	(17,389)	[4,173]	{2,087}	87,320	(17,464)	[4,191]	{2,096}	87,705	(17,541)	[4,210]	{2,105}

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.