

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

Date: 3/5/21

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 3/5/21 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.**

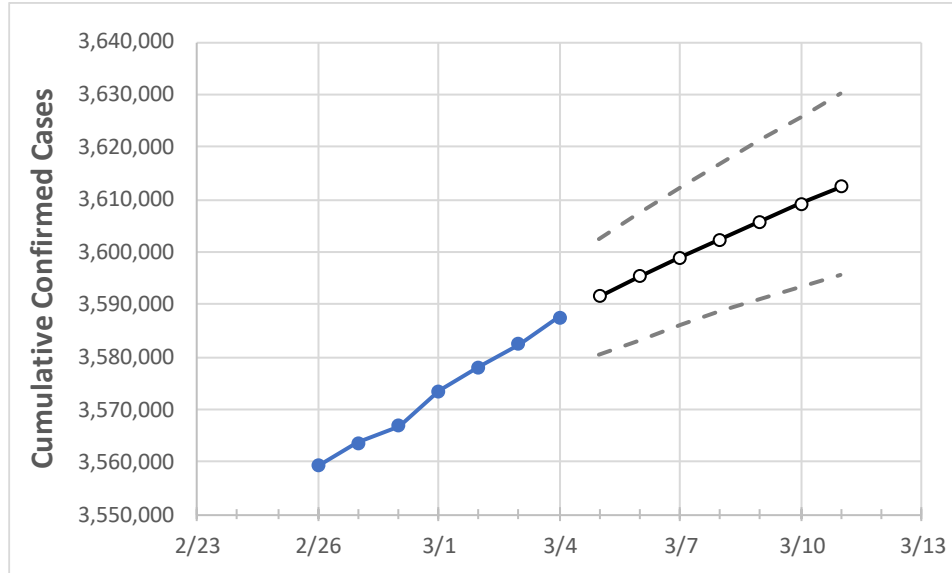
### IEM's Modeling Lead

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:						
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11

California	3,573,549	3,577,966	3,582,320	3,587,567	3,591,511	3,595,269	3,598,901	3,602,397	3,605,775	3,609,120	3,612,398
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*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:						
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11
Alameda	80,777	80,873	80,950	81,086	81,176	81,258	81,341	81,416	81,490	81,560	81,627
Contra Costa	62,720	62,818	62,931	63,053	63,162	63,266	63,369	63,471	63,568	63,666	63,760
Fresno	95,548	95,677	95,785	95,893	96,018	96,138	96,253	96,367	96,475	96,580	96,686
Kern	103,422	103,622	103,756	103,894	104,029	104,160	104,288	104,417	104,538	104,650	104,759
Lake	3,164	3,167	3,169	3,175	3,181	3,187	3,193	3,198	3,203	3,209	3,214
Los Angeles	1,192,954	1,194,333	1,196,017	1,198,178	1,199,378	1,200,561	1,201,730	1,202,844	1,203,902	1,204,886	1,205,874
Marin	13,231	13,261	13,285	13,316	13,339	13,362	13,384	13,407	13,429	13,451	13,473
Monterey	42,261	42,316	42,335	42,362	42,391	42,417	42,442	42,467	42,490	42,512	42,532
Orange	261,408	261,608	261,798	261,976	262,144	262,302	262,458	262,598	262,729	262,861	262,982
Placer	19,861	19,882	19,911	19,963	19,992	20,021	20,050	20,078	20,105	20,132	20,158
Riverside	289,773	290,325	290,498	290,744	290,886	291,031	291,162	291,285	291,403	291,502	291,607
Sacramento	93,528	93,678	93,790	93,947	94,089	94,227	94,365	94,503	94,641	94,768	94,892
San Bernardino	286,755	286,814	287,055	287,246	287,438	287,622	287,796	287,965	288,125	288,272	288,417
San Diego	260,625	261,001	261,353	261,861	262,220	262,567	262,893	263,214	263,521	263,815	264,098
San Francisco	34,291	34,318	34,387	34,443	34,489	34,531	34,572	34,611	34,649	34,687	34,721
San Joaquin	66,829	67,040	67,123	67,213	67,287	67,365	67,436	67,504	67,569	67,634	67,698
San Luis Obispo	19,696	19,724	19,751	19,797	19,821	19,846	19,869	19,891	19,912	19,932	19,951
San Mateo	39,059	39,096	39,148	39,189	39,246	39,300	39,351	39,401	39,449	39,497	39,544
Santa Barbara	32,050	32,087	32,147	32,219	32,273	32,327	32,377	32,425	32,471	32,518	32,563
Santa Clara	110,755	110,911	111,076	111,281	111,452	111,614	111,775	111,934	112,085	112,232	112,376
Santa Cruz	14,671	14,700	14,736	14,760	14,781	14,803	14,823	14,843	14,862	14,881	14,899
Solano	30,115	30,163	30,216	30,262	30,293	30,323	30,353	30,381	30,408	30,434	30,460
Sonoma	28,193	28,222	28,261	28,307	28,356	28,400	28,448	28,494	28,537	28,581	28,622
Ventura	77,749	77,849	77,952	78,057	78,141	78,221	78,297	78,367	78,434	78,497	78,559

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:											
	3/1	3/2	3/3	3/4	3/6			3/8			3/10					
Alameda	80,777	80,873	80,950	81,086	81,258	(16,252)	[3,900]	{1,950}	81,416	(16,283)	[3,908]	{1,954}	81,560	(16,312)	[3,915]	{1,957}
Contra Costa	62,720	62,818	62,931	63,053	63,266	(12,653)	[3,037]	{1,518}	63,471	(12,694)	[3,047]	{1,523}	63,666	(12,733)	[3,056]	{1,528}
Fresno	95,548	95,677	95,785	95,893	96,138	(19,228)	[4,615]	{2,307}	96,367	(19,273)	[4,626]	{2,313}	96,580	(19,316)	[4,636]	{2,318}
Kern	103,422	103,622	103,756	103,894	104,160	(20,832)	[5,000]	{2,500}	104,417	(20,883)	[5,012]	{2,506}	104,650	(20,930)	[5,023]	{2,512}
Lake	3,164	3,167	3,169	3,175	3,187	(637)	[153]	{76}	3,198	(640)	[154]	{77}	3,209	(642)	[154]	{77}
Los Angeles	1,192,954	1,194,333	1,196,017	1,198,178	1,200,561	(240,112)	[57,627]	{28,813}	1,202,844	(240,569)	[57,737]	{28,868}	1,204,886	(240,977)	[57,835]	{28,917}
Marin	13,231	13,261	13,285	13,316	13,362	(2,672)	[641]	{321}	13,407	(2,681)	[644]	{322}	13,451	(2,690)	[646]	{323}
Monterey	42,261	42,316	42,335	42,362	42,417	(8,483)	[2,036]	{1,018}	42,467	(8,493)	[2,038]	{1,019}	42,512	(8,502)	[2,041]	{1,020}
Orange	261,408	261,608	261,798	261,976	262,302	(52,460)	[12,590]	{6,295}	262,598	(52,520)	[12,605]	{6,302}	262,861	(52,572)	[12,617]	{6,309}
Placer	19,861	19,882	19,911	19,963	20,021	(4,004)	[961]	{481}	20,078	(4,016)	[964]	{482}	20,132	(4,026)	[966]	{483}
Riverside	289,773	290,325	290,498	290,744	291,031	(58,206)	[13,969]	{6,985}	291,285	(58,257)	[13,982]	{6,991}	291,502	(58,300)	[13,992]	{6,996}
Sacramento	93,528	93,678	93,790	93,947	94,227	(18,845)	[4,523]	{2,261}	94,503	(18,901)	[4,536]	{2,268}	94,768	(18,954)	[4,549]	{2,274}
San Bernardino	286,755	286,814	287,055	287,246	287,622	(57,524)	[13,806]	{6,903}	287,965	(57,593)	[13,822]	{6,911}	288,272	(57,654)	[13,837]	{6,919}
San Diego	260,625	261,001	261,353	261,861	262,567	(52,513)	[12,603]	{6,302}	263,214	(52,643)	[12,634]	{6,317}	263,815	(52,763)	[12,663]	{6,332}
San Francisco	34,291	34,318	34,387	34,443	34,531	(6,906)	[1,657]	{829}	34,611	(6,922)	[1,661]	{831}	34,687	(6,937)	[1,665]	{832}
San Joaquin	66,829	67,040	67,123	67,213	67,365	(13,473)	[3,234]	{1,617}	67,504	(13,501)	[3,240]	{1,620}	67,634	(13,527)	[3,246]	{1,623}
San Luis Obispo	19,696	19,724	19,751	19,797	19,846	(3,969)	[953]	{476}	19,891	(3,978)	[955]	{477}	19,932	(3,986)	[957]	{478}
San Mateo	39,059	39,096	39,148	39,189	39,300	(7,860)	[1,886]	{943}	39,401	(7,880)	[1,891]	{946}	39,497	(7,899)	[1,896]	{948}
Santa Barbara	32,050	32,087	32,147	32,219	32,327	(6,465)	[1,552]	{776}	32,425	(6,485)	[1,556]	{778}	32,518	(6,504)	[1,561]	{780}
Santa Clara	110,755	110,911	111,076	111,281	111,614	(22,323)	[5,357]	{2,679}	111,934	(22,387)	[5,373]	{2,686}	112,232	(22,446)	[5,387]	{2,694}
Santa Cruz	14,671	14,700	14,736	14,760	14,803	(2,961)	[711]	{355}	14,843	(2,969)	[712]	{356}	14,881	(2,976)	[714]	{357}
Solano	30,115	30,163	30,216	30,262	30,323	(6,065)	[1,456]	{728}	30,381	(6,076)	[1,458]	{729}	30,434	(6,087)	[1,461]	{730}
Sonoma	28,193	28,222	28,261	28,307	28,400	(5,680)	[1,363]	{682}	28,494	(5,699)	[1,368]	{684}	28,581	(5,716)	[1,372]	{686}
Ventura	77,749	77,849	77,952	78,057	78,221	(15,644)	[3,755]	{1,877}	78,367	(15,673)	[3,762]	{1,881}	78,497	(15,699)	[3,768]	{1,884}

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.