

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

Date: 4/9/21

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 4/9/21 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.**

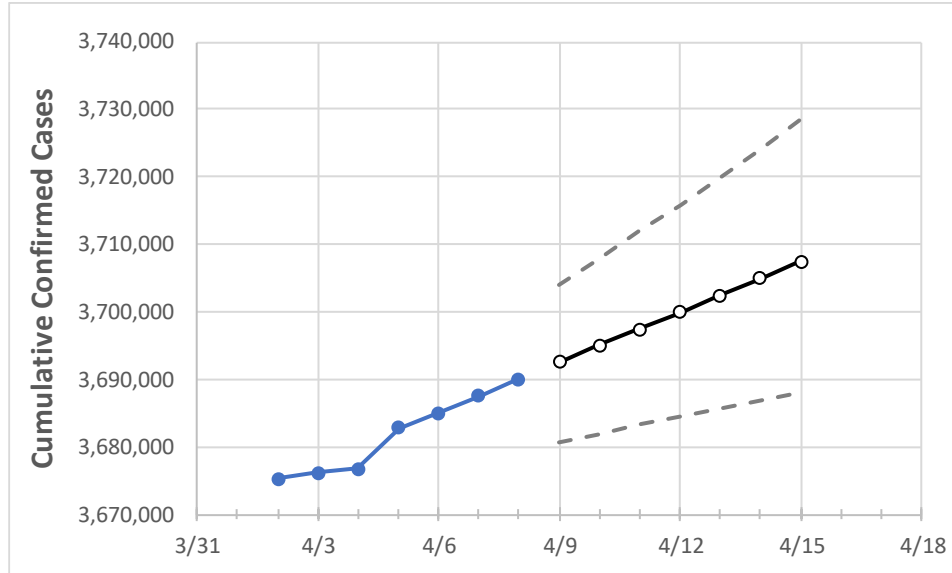
### IEM's Modeling Lead

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15

California 3,682,861 3,685,045 3,687,493 3,690,031 3,692,495 3,695,010 3,697,489 3,699,985 3,702,473 3,704,980 3,707,426

*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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Alameda	83,951	84,007	84,091	84,130	84,223	84,316	84,409	84,506	84,601	84,696	84,792
Contra Costa	65,718	65,835	65,882	65,967	66,043	66,118	66,194	66,270	66,344	66,420	66,493
Fresno	99,702	99,755	99,814	99,865	99,951	100,035	100,116	100,198	100,280	100,359	100,437
Kern	106,480	106,543	106,628	106,724	106,774	106,822	106,870	106,917	106,962	107,007	107,050
Lake	3,355	3,359	3,358	3,358	3,362	3,365	3,369	3,372	3,376	3,379	3,382
Los Angeles	1,222,479	1,222,802	1,223,205	1,223,821	1,224,300	1,224,770	1,225,226	1,225,675	1,226,120	1,226,555	1,226,982
Marin	13,730	13,743	13,760	13,777	13,787	13,797	13,807	13,816	13,825	13,834	13,843
Monterey	43,002	43,038	43,057	43,063	43,075	43,086	43,097	43,108	43,118	43,127	43,137
Orange	267,001	267,143	267,253	267,383	267,522	267,662	267,803	267,942	268,076	268,211	268,348
Placer	21,188	21,239	21,287	21,317	21,363	21,410	21,457	21,506	21,555	21,603	21,652
Riverside	295,426	295,631	295,770	295,896	296,095	296,294	296,504	296,721	296,943	297,173	297,406
Sacramento	98,848	99,042	99,157	99,268	99,460	99,658	99,854	100,053	100,247	100,452	100,656
San Bernardino	291,727	291,728	291,989	292,160	292,316	292,473	292,634	292,800	292,968	293,137	293,305
San Diego	271,654	271,866	272,194	272,494	272,738	272,986	273,225	273,470	273,715	273,963	274,211
San Francisco	35,525	35,538	35,572	35,618	35,649	35,681	35,713	35,742	35,775	35,806	35,839
San Joaquin	70,245	70,465	70,511	70,609	70,695	70,778	70,863	70,946	71,031	71,123	71,209
San Luis Obispo	20,606	20,649	20,671	20,704	20,729	20,753	20,778	20,803	20,828	20,852	20,877
San Mateo	40,595	40,618	40,649	40,708	40,748	40,789	40,829	40,869	40,910	40,951	40,991
Santa Barbara	33,358	33,381	33,408	33,427	33,457	33,487	33,517	33,546	33,576	33,604	33,632
Santa Clara	115,171	115,266	115,396	115,569	115,680	115,791	115,904	116,026	116,140	116,257	116,373
Santa Cruz	15,278	15,264	15,283	15,301	15,315	15,329	15,343	15,357	15,371	15,384	15,397
Solano	31,401	31,432	31,462	31,489	31,526	31,562	31,599	31,635	31,669	31,706	31,742
Sonoma	29,402	29,423	29,431	29,448	29,466	29,484	29,501	29,519	29,536	29,553	29,570
Ventura	79,820	79,830	79,867	79,894	79,916	79,937	79,956	79,975	79,993	80,010	80,026

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:											
	4/5	4/6	4/7	4/8	4/10			4/12			4/14					
Alameda	83,951	84,007	84,091	84,130	84,316	(16,863)	[4,047]	{2,024}	84,506	(16,901)	[4,056]	{2,028}	84,696	(16,939)	[4,065]	{2,033}
Contra Costa	65,718	65,835	65,882	65,967	66,118	(13,224)	[3,174]	{1,587}	66,270	(13,254)	[3,181]	{1,590}	66,420	(13,284)	[3,188]	{1,594}
Fresno	99,702	99,755	99,814	99,865	100,035	(20,007)	[4,802]	{2,401}	100,198	(20,040)	[4,810]	{2,405}	100,359	(20,072)	[4,817]	{2,409}
Kern	106,480	106,543	106,628	106,724	106,822	(21,364)	[5,127]	{2,564}	106,917	(21,383)	[5,132]	{2,566}	107,007	(21,401)	[5,136]	{2,568}
Lake	3,355	3,359	3,358	3,358	3,365	(673)	[162]	{81}	3,372	(674)	[162]	{81}	3,379	(676)	[162]	{81}
Los Angeles	1,222,479	1,222,802	1,223,205	1,223,821	1,224,770	(244,954)	[58,789]	{29,394}	1,225,675	(245,135)	[58,832]	{29,416}	1,226,555	(245,311)	[58,875]	{29,437}
Marin	13,730	13,743	13,760	13,777	13,797	(2,759)	[662]	{331}	13,816	(2,763)	[663]	{332}	13,834	(2,767)	[664]	{332}
Monterey	43,002	43,038	43,057	43,063	43,086	(8,617)	[2,068]	{1,034}	43,108	(8,622)	[2,069]	{1,035}	43,127	(8,625)	[2,070]	{1,035}
Orange	267,001	267,143	267,253	267,383	267,662	(53,532)	[12,848]	{6,424}	267,942	(53,588)	[12,861]	{6,431}	268,211	(53,642)	[12,874]	{6,437}
Placer	21,188	21,239	21,287	21,317	21,410	(4,282)	[1,028]	{514}	21,506	(4,301)	[1,032]	{516}	21,603	(4,321)	[1,037]	{518}
Riverside	295,426	295,631	295,770	295,896	296,294	(59,259)	[14,222]	{7,111}	296,721	(59,344)	[14,243]	{7,121}	297,173	(59,435)	[14,264]	{7,132}
Sacramento	98,848	99,042	99,157	99,268	99,658	(19,932)	[4,784]	{2,392}	100,053	(20,011)	[4,803]	{2,401}	100,452	(20,090)	[4,822]	{2,411}
San Bernardino	291,727	291,728	291,989	292,160	292,473	(58,495)	[14,039]	{7,019}	292,800	(58,560)	[14,054]	{7,027}	293,137	(58,627)	[14,071]	{7,035}
San Diego	271,654	271,866	272,194	272,494	272,986	(54,597)	[13,103]	{6,552}	273,470	(54,694)	[13,127]	{6,563}	273,963	(54,793)	[13,150]	{6,575}
San Francisco	35,525	35,538	35,572	35,618	35,681	(7,136)	[1,713]	{856}	35,742	(7,148)	[1,716]	{858}	35,806	(7,161)	[1,719]	{859}
San Joaquin	70,245	70,465	70,511	70,609	70,778	(14,156)	[3,397]	{1,699}	70,946	(14,189)	[3,405]	{1,703}	71,123	(14,225)	[3,414]	{1,707}
San Luis Obispo	20,606	20,649	20,671	20,704	20,753	(4,151)	[996]	{498}	20,803	(4,161)	[999]	{499}	20,852	(4,170)	[1,001]	{500}
San Mateo	40,595	40,618	40,649	40,708	40,789	(8,158)	[1,958]	{979}	40,869	(8,174)	[1,962]	{981}	40,951	(8,190)	[1,966]	{983}
Santa Barbara	33,358	33,381	33,408	33,427	33,487	(6,697)	[1,607]	{804}	33,546	(6,709)	[1,610]	{805}	33,604	(6,721)	[1,613]	{806}
Santa Clara	115,171	115,266	115,396	115,569	115,791	(23,158)	[5,558]	{2,779}	116,026	(23,205)	[5,569]	{2,785}	116,257	(23,251)	[5,580]	{2,790}
Santa Cruz	15,278	15,264	15,283	15,301	15,329	(3,066)	[736]	{368}	15,357	(3,071)	[737]	{369}	15,384	(3,077)	[738]	{369}
Solano	31,401	31,432	31,462	31,489	31,562	(6,312)	[1,515]	{757}	31,635	(6,327)	[1,518]	{759}	31,706	(6,341)	[1,522]	{761}
Sonoma	29,402	29,423	29,431	29,448	29,484	(5,897)	[1,415]	{708}	29,519	(5,904)	[1,417]	{708}	29,553	(5,911)	[1,419]	{709}
Ventura	79,820	79,830	79,867	79,894	79,937	(15,987)	[3,837]	{1,918}	79,975	(15,995)	[3,839]	{1,919}	80,010	(16,002)	[3,840]	{1,920}

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.