

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

**Date: 5/5/21**

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 5/5/21 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.**

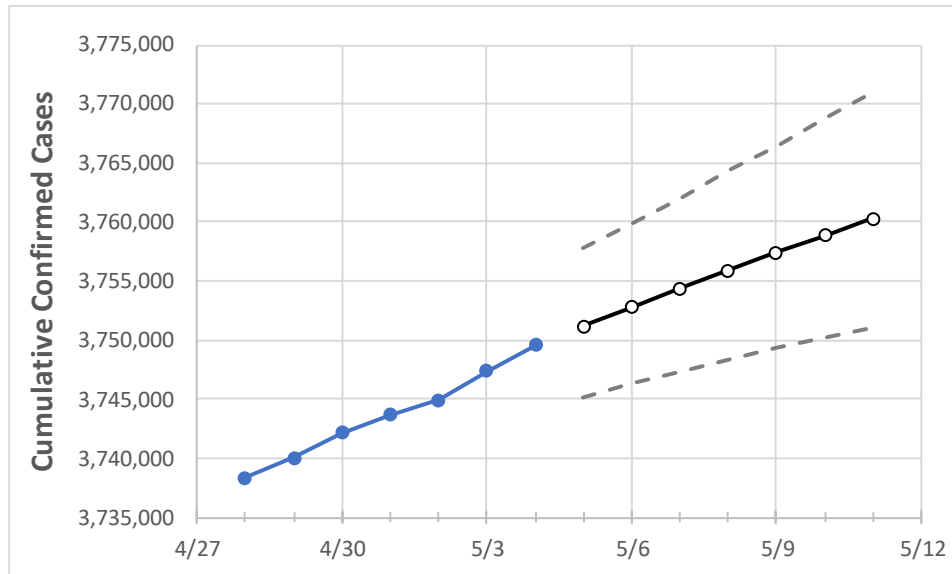
### **IEM's Modeling Lead**

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:						
	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11
California	3,743,681	3,744,937	3,747,337	3,749,580	3,751,203	3,752,792	3,754,369	3,755,869	3,757,390	3,758,827	3,760,296

*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:						
	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11
Alameda	86,602	86,704	86,784	87,326	87,526	87,743	87,973	88,220	88,481	88,764	89,071
Contra Costa	68,051	68,115	68,167	68,212	68,277	68,341	68,404	68,466	68,527	68,586	68,645
Fresno	101,263	101,326	101,372	101,405	101,447	101,489	101,530	101,569	101,609	101,649	101,686
Kern	108,598	108,628	108,652	108,719	108,760	108,800	108,839	108,877	108,913	108,949	108,985
Lake	3,440	3,441	3,443	3,446	3,448	3,449	3,451	3,452	3,454	3,455	3,457
Los Angeles	1,233,505	1,233,772	1,233,998	1,234,242	1,234,507	1,234,766	1,235,019	1,235,261	1,235,498	1,235,730	1,235,956
Marin	13,975	13,981	13,989	14,000	14,010	14,020	14,031	14,042	14,053	14,064	14,075
Monterey	43,461	43,469	43,476	43,490	43,502	43,513	43,523	43,534	43,544	43,554	43,564
Orange	270,194	270,284	270,345	270,444	270,520	270,595	270,670	270,742	270,814	270,883	270,952
Placer	22,231	22,240	22,323	22,358	22,388	22,418	22,448	22,479	22,508	22,538	22,568
Riverside	298,491	298,531	298,572	298,777	298,840	298,903	298,961	299,020	299,075	299,130	299,187
Sacramento	103,001	103,043	103,386	103,498	103,614	103,729	103,840	103,956	104,068	104,180	104,292
San Bernardino	296,009	296,089	296,146	296,188	296,253	296,315	296,374	296,431	296,483	296,535	296,585
San Diego	276,366	276,520	276,692	276,878	277,009	277,134	277,257	277,374	277,493	277,607	277,718
San Francisco	36,453	36,496	36,522	36,538	36,566	36,595	36,624	36,651	36,679	36,707	36,734
San Joaquin	72,543	72,607	72,672	72,724	72,789	72,854	72,920	72,984	73,051	73,114	73,183
San Luis Obispo	21,193	21,195	21,196	21,222	21,234	21,246	21,258	21,269	21,280	21,291	21,301
San Mateo	41,583	41,617	41,656	41,689	41,723	41,756	41,789	41,823	41,856	41,889	41,921
Santa Barbara	34,205	34,223	34,238	34,250	34,270	34,290	34,308	34,328	34,347	34,366	34,384
Santa Clara	118,369	118,424	118,479	118,541	118,610	118,677	118,743	118,805	118,867	118,926	118,984
Santa Cruz	16,005	16,011	16,017	16,023	16,045	16,065	16,087	16,109	16,130	16,151	16,172
Solano	32,514	32,551	32,588	32,613	32,652	32,690	32,728	32,766	32,805	32,842	32,879
Sonoma	29,876	29,886	29,897	29,910	29,921	29,933	29,943	29,954	29,965	29,975	29,985
Ventura	80,642	80,668	80,693	80,748	80,775	80,802	80,829	80,856	80,883	80,910	80,936

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:											
	5/1	5/2	5/3	5/4	5/6				5/8				5/10			
Alameda	86,602	86,704	86,784	87,326	87,743	(17,549)	[4,212]	{2,106}	88,220	(17,644)	[4,235]	{2,117}	88,764	(17,753)	[4,261]	{2,130}
Contra Costa	68,051	68,115	68,167	68,212	68,341	(13,668)	[3,280]	{1,640}	68,466	(13,693)	[3,286]	{1,643}	68,586	(13,717)	[3,292]	{1,646}
Fresno	101,263	101,326	101,372	101,405	101,489	(20,298)	[4,871]	{2,436}	101,569	(20,314)	[4,875]	{2,438}	101,649	(20,330)	[4,879]	{2,440}
Kern	108,598	108,628	108,652	108,719	108,800	(21,760)	[5,222]	{2,611}	108,877	(21,775)	[5,226]	{2,613}	108,949	(21,790)	[5,230]	{2,615}
Lake	3,440	3,441	3,443	3,446	3,449	(690)	[166]	{83}	3,452	(690)	[166]	{83}	3,455	(691)	[166]	{83}
Los Angeles	1,233,505	1,233,772	1,233,998	1,234,242	1,234,766	(246,953)	[59,269]	{29,634}	1,235,261	(247,052)	[59,293]	{29,646}	1,235,730	(247,146)	[59,315]	{29,658}
Marin	13,975	13,981	13,989	14,000	14,020	(2,804)	[673]	{336}	14,042	(2,808)	[674]	{337}	14,064	(2,813)	[675]	{338}
Monterey	43,461	43,469	43,476	43,490	43,513	(8,703)	[2,089]	{1,044}	43,534	(8,707)	[2,090]	{1,045}	43,554	(8,711)	[2,091]	{1,045}
Orange	270,194	270,284	270,345	270,444	270,595	(54,119)	[12,989]	{6,494}	270,742	(54,148)	[12,996]	{6,498}	270,883	(54,177)	[13,002]	{6,501}
Placer	22,231	22,240	22,323	22,358	22,418	(4,484)	[1,076]	{538}	22,479	(4,496)	[1,079]	{539}	22,538	(4,508)	[1,082]	{541}
Riverside	298,491	298,531	298,572	298,777	298,903	(59,781)	[14,347]	{7,174}	299,020	(59,804)	[14,353]	{7,176}	299,130	(59,826)	[14,358]	{7,179}
Sacramento	103,001	103,043	103,386	103,498	103,729	(20,746)	[4,979]	{2,489}	103,956	(20,791)	[4,990]	{2,495}	104,180	(20,836)	[5,001]	{2,500}
San Bernardino	296,009	296,089	296,146	296,188	296,315	(59,263)	[14,223]	{7,112}	296,431	(59,286)	[14,229]	{7,114}	296,535	(59,307)	[14,234]	{7,117}
San Diego	276,366	276,520	276,692	276,878	277,134	(55,427)	[13,302]	{6,651}	277,374	(55,475)	[13,314]	{6,657}	277,607	(55,521)	[13,325]	{6,663}
San Francisco	36,453	36,496	36,522	36,538	36,595	(7,319)	[1,757]	{878}	36,651	(7,330)	[1,759]	{880}	36,707	(7,341)	[1,762]	{881}
San Joaquin	72,543	72,607	72,672	72,724	72,854	(14,571)	[3,497]	{1,748}	72,984	(14,597)	[3,503]	{1,752}	73,114	(14,623)	[3,509]	{1,755}
San Luis Obispo	21,193	21,195	21,196	21,222	21,246	(4,249)	[1,020]	{510}	21,269	(4,254)	[1,021]	{510}	21,291	(4,258)	[1,022]	{511}
San Mateo	41,583	41,617	41,656	41,689	41,756	(8,351)	[2,004]	{1,002}	41,823	(8,365)	[2,007]	{1,004}	41,889	(8,378)	[2,011]	{1,005}
Santa Barbara	34,205	34,223	34,238	34,250	34,290	(6,858)	[1,646]	{823}	34,328	(6,866)	[1,648]	{824}	34,366	(6,873)	[1,650]	{825}
Santa Clara	118,369	118,424	118,479	118,541	118,677	(23,735)	[5,696]	{2,848}	118,805	(23,761)	[5,703]	{2,851}	118,926	(23,785)	[5,708]	{2,854}
Santa Cruz	16,005	16,011	16,017	16,023	16,065	(3,213)	[771]	{386}	16,109	(3,222)	[773]	{387}	16,151	(3,230)	[775]	{388}
Solano	32,514	32,551	32,588	32,613	32,690	(6,538)	[1,569]	{785}	32,766	(6,553)	[1,573]	{786}	32,842	(6,568)	[1,576]	{788}
Sonoma	29,876	29,886	29,897	29,910	29,933	(5,987)	[1,437]	{718}	29,954	(5,991)	[1,438]	{719}	29,975	(5,995)	[1,439]	{719}
Ventura	80,642	80,668	80,693	80,748	80,802	(16,160)	[3,879]	{1,939}	80,856	(16,171)	[3,881]	{1,941}	80,910	(16,182)	[3,884]	{1,942}

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.