

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

**Date: 4/30/21**

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 4/30/21 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.**

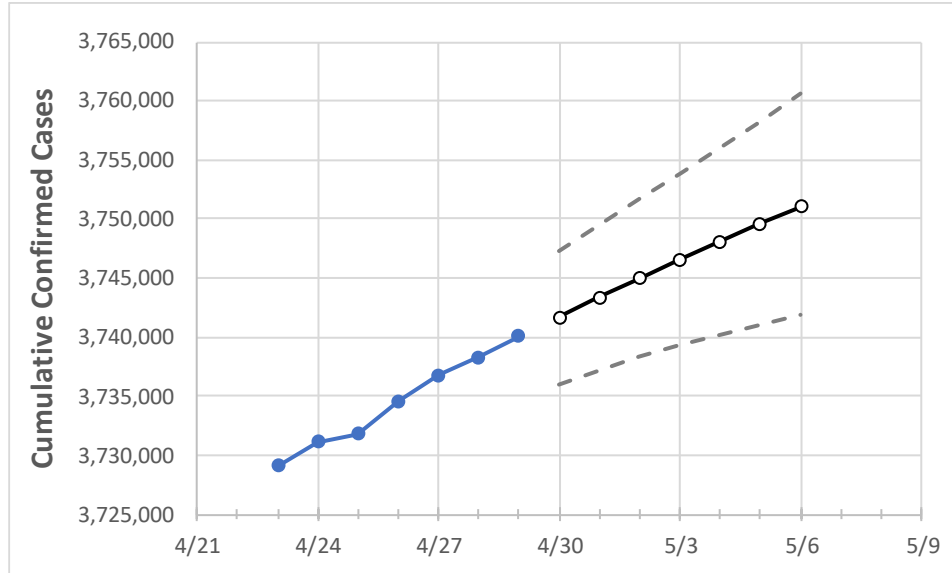
### **IEM's Modeling Lead**

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:						
	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5	5/6
California	3,734,562	3,736,745	3,738,327	3,740,038	3,741,704	3,743,342	3,744,953	3,746,541	3,748,108	3,749,631	3,751,063

*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:						
	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5	5/6
Alameda	86,162	86,230	86,301	86,390	86,483	86,575	86,671	86,765	86,858	86,951	87,044
Contra Costa	67,670	67,746	67,816	67,880	67,956	68,027	68,100	68,172	68,241	68,313	68,382
Fresno	101,061	101,099	101,138	101,161	101,206	101,251	101,295	101,338	101,380	101,421	101,461
Kern	108,313	108,418	108,456	108,479	108,522	108,564	108,601	108,636	108,673	108,710	108,744
Lake	3,427	3,428	3,431	3,433	3,435	3,437	3,438	3,440	3,441	3,443	3,444
Los Angeles	1,231,838	1,232,131	1,232,391	1,232,751	1,233,042	1,233,325	1,233,595	1,233,860	1,234,118	1,234,364	1,234,612
Marin	13,913	13,926	13,937	13,950	13,959	13,969	13,978	13,988	13,999	14,009	14,019
Monterey	43,385	43,390	43,422	43,443	43,455	43,467	43,480	43,492	43,504	43,516	43,528
Orange	269,724	269,838	269,949	270,014	270,094	270,171	270,247	270,321	270,393	270,463	270,531
Placer	22,107	22,120	22,151	22,193	22,220	22,246	22,271	22,297	22,321	22,344	22,366
Riverside	298,001	298,259	298,262	298,366	298,428	298,486	298,541	298,597	298,648	298,698	298,743
Sacramento	102,486	102,614	102,683	102,793	102,906	103,015	103,127	103,236	103,343	103,439	103,536
San Bernardino	295,565	295,665	295,752	295,806	295,883	295,959	296,030	296,098	296,165	296,228	296,289
San Diego	275,540	275,684	275,820	275,960	276,077	276,185	276,292	276,397	276,497	276,593	276,685
San Francisco	36,310	36,330	36,358	36,382	36,412	36,441	36,470	36,498	36,526	36,554	36,581
San Joaquin	71,987	72,281	72,345	72,395	72,455	72,516	72,573	72,631	72,690	72,745	72,799
San Luis Obispo	21,130	21,138	21,164	21,180	21,198	21,215	21,231	21,248	21,265	21,281	21,296
San Mateo	41,465	41,457	41,474	41,498	41,531	41,563	41,596	41,627	41,658	41,690	41,721
Santa Barbara	34,073	34,099	34,128	34,164	34,190	34,217	34,243	34,269	34,295	34,322	34,348
Santa Clara	117,965	118,036	118,094	118,181	118,271	118,359	118,445	118,526	118,610	118,690	118,769
Santa Cruz	15,899	15,929	15,968	15,984	16,020	16,056	16,095	16,133	16,173	16,211	16,251
Solano	32,313	32,345	32,366	32,412	32,449	32,486	32,523	32,560	32,596	32,632	32,668
Sonoma	29,794	29,807	29,818	29,832	29,841	29,849	29,857	29,864	29,870	29,877	29,883
Ventura	80,502	80,554	80,576	80,597	80,624	80,651	80,678	80,704	80,729	80,755	80,779

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:											
	4/26	4/27	4/28	4/29	5/1				5/3				5/5			
Alameda	86,162	86,230	86,301	86,390	86,575	(17,315)	[4,156]	{2,078}	86,765	(17,353)	[4,165]	{2,082}	86,951	(17,390)	[4,174]	{2,087}
Contra Costa	67,670	67,746	67,816	67,880	68,027	(13,605)	[3,265]	{1,633}	68,172	(13,634)	[3,272]	{1,636}	68,313	(13,663)	[3,279]	{1,640}
Fresno	101,061	101,099	101,138	101,161	101,251	(20,250)	[4,860]	{2,430}	101,338	(20,268)	[4,864]	{2,432}	101,421	(20,284)	[4,868]	{2,434}
Kern	108,313	108,418	108,456	108,479	108,564	(21,713)	[5,211]	{2,606}	108,636	(21,727)	[5,215]	{2,607}	108,710	(21,742)	[5,218]	{2,609}
Lake	3,427	3,428	3,431	3,433	3,437	(687)	[165]	{82}	3,440	(688)	[165]	{83}	3,443	(689)	[165]	{83}
Los Angeles	1,231,838	1,232,131	1,232,391	1,232,751	1,233,325	(246,665)	[59,200]	{29,600}	1,233,860	(246,772)	[59,225]	{29,613}	1,234,364	(246,873)	[59,249]	{29,625}
Marin	13,913	13,926	13,937	13,950	13,969	(2,794)	[670]	{335}	13,988	(2,798)	[671]	{336}	14,009	(2,802)	[672]	{336}
Monterey	43,385	43,390	43,422	43,443	43,467	(8,693)	[2,086]	{1,043}	43,492	(8,698)	[2,088]	{1,044}	43,516	(8,703)	[2,089]	{1,044}
Orange	269,724	269,838	269,949	270,014	270,171	(54,034)	[12,968]	{6,484}	270,321	(54,064)	[12,975]	{6,488}	270,463	(54,093)	[12,982]	{6,491}
Placer	22,107	22,120	22,151	22,193	22,246	(4,449)	[1,068]	{534}	22,297	(4,459)	[1,070]	{535}	22,344	(4,469)	[1,072]	{536}
Riverside	298,001	298,259	298,262	298,366	298,486	(59,697)	[14,327]	{7,164}	298,597	(59,719)	[14,333]	{7,166}	298,698	(59,740)	[14,337]	{7,169}
Sacramento	102,486	102,614	102,683	102,793	103,015	(20,603)	[4,945]	{2,472}	103,236	(20,647)	[4,955]	{2,478}	103,439	(20,688)	[4,965]	{2,483}
San Bernardino	295,565	295,665	295,752	295,806	295,959	(59,192)	[14,206]	{7,103}	296,098	(59,220)	[14,213]	{7,106}	296,228	(59,246)	[14,219]	{7,109}
San Diego	275,540	275,684	275,820	275,960	276,185	(55,237)	[13,257]	{6,628}	276,397	(55,279)	[13,267]	{6,634}	276,593	(55,319)	[13,276]	{6,638}
San Francisco	36,310	36,330	36,358	36,382	36,441	(7,288)	[1,749]	{875}	36,498	(7,300)	[1,752]	{876}	36,554	(7,311)	[1,755]	{877}
San Joaquin	71,987	72,281	72,345	72,395	72,516	(14,503)	[3,481]	{1,740}	72,631	(14,526)	[3,486]	{1,743}	72,745	(14,549)	[3,492]	{1,746}
San Luis Obispo	21,130	21,138	21,164	21,180	21,215	(4,243)	[1,018]	{509}	21,248	(4,250)	[1,020]	{510}	21,281	(4,256)	[1,021]	{511}
San Mateo	41,465	41,457	41,474	41,498	41,563	(8,313)	[1,995]	{998}	41,627	(8,325)	[1,998]	{999}	41,690	(8,338)	[2,001]	{1,001}
Santa Barbara	34,073	34,099	34,128	34,164	34,217	(6,843)	[1,642]	{821}	34,269	(6,854)	[1,645]	{822}	34,322	(6,864)	[1,647]	{824}
Santa Clara	117,965	118,036	118,094	118,181	118,359	(23,672)	[5,681]	{2,841}	118,526	(23,705)	[5,689]	{2,845}	118,690	(23,738)	[5,697]	{2,849}
Santa Cruz	15,899	15,929	15,968	15,984	16,056	(3,211)	[771]	{385}	16,133	(3,227)	[774]	{387}	16,211	(3,242)	[778]	{389}
Solano	32,313	32,345	32,366	32,412	32,486	(6,497)	[1,559]	{780}	32,560	(6,512)	[1,563]	{781}	32,632	(6,526)	[1,566]	{783}
Sonoma	29,794	29,807	29,818	29,832	29,849	(5,970)	[1,433]	{716}	29,864	(5,973)	[1,433]	{717}	29,877	(5,975)	[1,434]	{717}
Ventura	80,502	80,554	80,576	80,597	80,651	(16,130)	[3,871]	{1,936}	80,704	(16,141)	[3,874]	{1,937}	80,755	(16,151)	[3,876]	{1,938}

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.