

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

Date: 6/21/21

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 6/21/21 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.

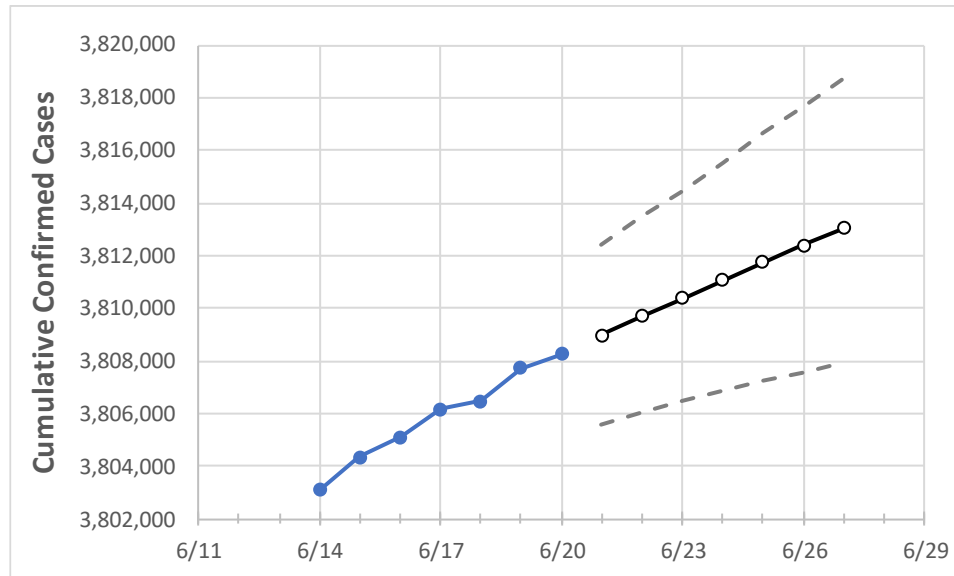
IEM's Modeling Lead

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:							
	6/17	6/18	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	
California	3,806,154	3,806,465	3,807,726	3,808,258	3,808,988	3,809,700	3,810,381	3,811,080	3,811,746	3,812,409	3,813,033	

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:						
	6/17	6/18	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27
Alameda	89,562	89,577	89,592	89,592	89,621	89,650	89,678	89,707	89,735	89,762	89,788
Contra Costa	70,478	70,520	70,561	70,561	70,606	70,651	70,695	70,739	70,784	70,829	70,872
Fresno	102,842	102,867	102,894	102,922	102,941	102,959	102,977	102,995	103,013	103,030	103,048
Kern	110,710	110,734	110,762	110,782	110,803	110,823	110,843	110,863	110,883	110,902	110,920
Lake	3,562	3,563	3,563	3,563	3,565	3,567	3,570	3,572	3,574	3,576	3,578
Los Angeles	1,247,033	1,247,197	1,247,361	1,247,618	1,247,798	1,247,976	1,248,159	1,248,338	1,248,516	1,248,693	1,248,883
Marin	14,193	14,196	14,200	14,200	14,204	14,208	14,212	14,216	14,220	14,224	14,228
Monterey	43,831	43,831	43,831	43,831	43,836	43,842	43,847	43,852	43,858	43,863	43,869
Orange	272,877	272,922	272,922	272,922	272,960	272,996	273,032	273,067	273,102	273,137	273,171
Placer	23,477	23,498	23,518	23,537	23,562	23,587	23,613	23,639	23,664	23,690	23,715
Riverside	301,543	301,573	301,603	301,603	301,645	301,685	301,723	301,762	301,801	301,841	301,880
Sacramento	107,560	107,599	107,638	107,638	107,670	107,701	107,732	107,762	107,792	107,818	107,846
San Bernardino	299,151	299,186	299,243	299,289	299,334	299,378	299,424	299,471	299,519	299,566	299,614
San Diego	281,530	281,531	281,681	281,749	281,817	281,884	281,952	282,018	282,084	282,150	282,217
San Francisco	37,222	37,243	37,246	37,256	37,265	37,273	37,282	37,290	37,299	37,307	37,315
San Joaquin	74,629	74,658	74,686	74,686	74,726	74,764	74,804	74,844	74,882	74,921	74,959
San Luis Obispo	21,421	21,421	21,421	21,421	21,423	21,426	21,428	21,430	21,432	21,433	21,435
San Mateo	42,601	42,615	42,630	42,646	42,663	42,679	42,695	42,712	42,728	42,744	42,760
Santa Barbara	34,593	34,595	34,596	34,596	34,599	34,603	34,606	34,610	34,613	34,616	34,619
Santa Clara	119,982	120,032	120,081	120,110	120,143	120,176	120,209	120,243	120,277	120,311	120,345
Santa Cruz	16,232	16,234	16,235	16,235	16,239	16,243	16,247	16,251	16,255	16,260	16,264
Solano	33,673	33,690	33,707	33,707	33,720	33,734	33,748	33,762	33,776	33,790	33,803
Sonoma	30,825	30,847	30,868	30,868	30,898	30,927	30,957	30,988	31,019	31,051	31,082
Ventura	81,619	81,628	81,638	81,638	81,647	81,655	81,663	81,671	81,678	81,686	81,693

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:											
	6/17	6/18	6/19	6/20	6/22				6/24				6/26			
Alameda	89,562	89,577	89,592	89,592	89,650	(17,930)	[4,303]	{2,152}	89,707	(17,941)	[4,306]	{2,153}	89,762	(17,952)	[4,309]	{2,154}
Contra Costa	70,478	70,520	70,561	70,561	70,651	(14,130)	[3,391]	{1,696}	70,739	(14,148)	[3,395]	{1,698}	70,829	(14,166)	[3,400]	{1,700}
Fresno	102,842	102,867	102,894	102,922	102,959	(20,592)	[4,942]	{2,471}	102,995	(20,599)	[4,944]	{2,472}	103,030	(20,606)	[4,945]	{2,473}
Kern	110,710	110,734	110,762	110,782	110,823	(22,165)	[5,320]	{2,660}	110,863	(22,173)	[5,321]	{2,661}	110,902	(22,180)	[5,323]	{2,662}
Lake	3,562	3,563	3,563	3,563	3,567	(713)	[171]	{86}	3,572	(714)	[171]	{86}	3,576	(715)	[172]	{86}
Los Angeles	1,247,033	1,247,197	1,247,361	1,247,618	1,247,976	(249,595)	[59,903]	{29,951}	1,248,338	(249,668)	[59,920]	{29,960}	1,248,693	(249,739)	[59,937]	{29,969}
Marin	14,193	14,196	14,200	14,200	14,208	(2,842)	[682]	{341}	14,216	(2,843)	[682]	{341}	14,224	(2,845)	[683]	{341}
Monterey	43,831	43,831	43,831	43,831	43,842	(8,768)	[2,104]	{1,052}	43,852	(8,770)	[2,105]	{1,052}	43,863	(8,773)	[2,105]	{1,053}
Orange	272,877	272,922	272,922	272,922	272,996	(54,599)	[13,104]	{6,552}	273,067	(54,613)	[13,107]	{6,554}	273,137	(54,627)	[13,111]	{6,555}
Placer	23,477	23,498	23,518	23,537	23,587	(4,717)	[1,132]	{566}	23,639	(4,728)	[1,135]	{567}	23,690	(4,738)	[1,137]	{569}
Riverside	301,543	301,573	301,603	301,603	301,685	(60,337)	[14,481]	{7,240}	301,762	(60,352)	[14,485]	{7,242}	301,841	(60,368)	[14,488]	{7,244}
Sacramento	107,560	107,599	107,638	107,638	107,701	(21,540)	[5,170]	{2,585}	107,762	(21,552)	[5,173]	{2,586}	107,818	(21,564)	[5,175]	{2,588}
San Bernardino	299,151	299,186	299,243	299,289	299,378	(59,876)	[14,370]	{7,185}	299,471	(59,894)	[14,375]	{7,187}	299,566	(59,913)	[14,379]	{7,190}
San Diego	281,530	281,531	281,681	281,749	281,884	(56,377)	[13,530]	{6,765}	282,018	(56,404)	[13,537]	{6,768}	282,150	(56,430)	[13,543]	{6,772}
San Francisco	37,222	37,243	37,246	37,256	37,273	(7,455)	[1,789]	{895}	37,290	(7,458)	[1,790]	{895}	37,307	(7,461)	[1,791]	{895}
San Joaquin	74,629	74,658	74,686	74,686	74,764	(14,953)	[3,589]	{1,794}	74,844	(14,969)	[3,592]	{1,796}	74,921	(14,984)	[3,596]	{1,798}
San Luis Obispo	21,421	21,421	21,421	21,421	21,426	(4,285)	[1,028]	{514}	21,430	(4,286)	[1,029]	{514}	21,433	(4,287)	[1,029]	{514}
San Mateo	42,601	42,615	42,630	42,646	42,679	(8,536)	[2,049]	{1,024}	42,712	(8,542)	[2,050]	{1,025}	42,744	(8,549)	[2,052]	{1,026}
Santa Barbara	34,593	34,595	34,596	34,596	34,603	(6,921)	[1,661]	{830}	34,610	(6,922)	[1,661]	{831}	34,616	(6,923)	[1,662]	{831}
Santa Clara	119,982	120,032	120,081	120,110	120,176	(24,035)	[5,768]	{2,884}	120,243	(24,049)	[5,772]	{2,886}	120,311	(24,062)	[5,775]	{2,887}
Santa Cruz	16,232	16,234	16,235	16,235	16,243	(3,249)	[780]	{390}	16,251	(3,250)	[780]	{390}	16,260	(3,252)	[780]	{390}
Solano	33,673	33,690	33,707	33,707	33,734	(6,747)	[1,619]	{810}	33,762	(6,752)	[1,621]	{810}	33,790	(6,758)	[1,622]	{811}
Sonoma	30,825	30,847	30,868	30,868	30,927	(6,185)	[1,485]	{742}	30,988	(6,198)	[1,487]	{744}	31,051	(6,210)	[1,490]	{745}
Ventura	81,619	81,628	81,638	81,638	81,655	(16,331)	[3,919]	{1,960}	81,671	(16,334)	[3,920]	{1,960}	81,686	(16,337)	[3,921]	{1,960}

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.