

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

Date: 6/24/21

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 6/24/21 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.

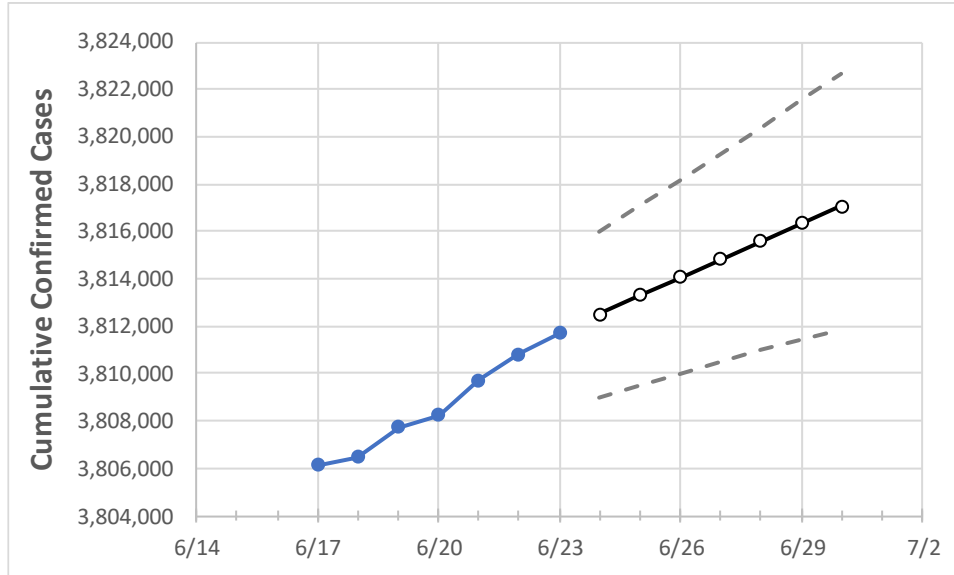
IEM's Modeling Lead

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:						
	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30

California 3,808,258 3,809,710 3,810,808 3,811,723 3,812,504 3,813,293 3,814,063 3,814,826 3,815,575 3,816,336 3,817,081

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:							
	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30	
Alameda	89,626	89,659	89,756	89,819	89,861	89,901	89,942	89,984	90,027	90,071	90,115	
Contra Costa	70,646	70,730	70,770	70,818	70,872	70,928	70,985	71,043	71,101	71,159	71,217	
Fresno	102,922	102,947	102,971	102,996	103,017	103,038	103,059	103,080	103,101	103,122	103,143	
Kern	110,782	110,799	110,823	110,847	110,866	110,884	110,902	110,919	110,936	110,953	110,968	
Lake	3,563	3,564	3,564	3,564	3,565	3,566	3,568	3,569	3,570	3,571	3,572	
Los Angeles	1,247,618	1,247,744	1,247,909	1,248,161	1,248,349	1,248,540	1,248,725	1,248,915	1,249,103	1,249,290	1,249,483	
Marin	14,203	14,206	14,208	14,207	14,210	14,214	14,217	14,220	14,224	14,227	14,230	
Monterey	43,835	43,836	43,842	43,842	43,846	43,849	43,853	43,856	43,860	43,863	43,866	
Orange	273,012	273,057	273,105	273,128	273,166	273,204	273,242	273,278	273,314	273,350	273,385	
Placer	23,537	23,589	23,604	23,633	23,661	23,690	23,718	23,747	23,776	23,806	23,836	
Riverside	301,636	301,668	301,799	301,799	301,846	301,895	301,942	301,992	302,042	302,093	302,143	
Sacramento	107,730	107,821	107,872	107,913	107,956	107,997	108,039	108,079	108,118	108,156	108,193	
San Bernardino	299,289	299,305	299,320	299,372	299,407	299,441	299,476	299,511	299,546	299,578	299,613	
San Diego	281,749	281,810	281,886	281,936	281,999	282,061	282,124	282,188	282,250	282,310	282,374	
San Francisco	37,256	37,269	37,275	37,287	37,296	37,306	37,315	37,325	37,334	37,343	37,352	
San Joaquin	74,707	74,727	74,808	74,808	74,844	74,880	74,918	74,956	74,993	75,031	75,071	
San Luis Obispo	21,440	21,444	21,448	21,448	21,452	21,455	21,459	21,462	21,465	21,468	21,471	
San Mateo	42,646	42,681	42,685	42,725	42,744	42,763	42,782	42,801	42,821	42,840	42,861	
Santa Barbara	34,605	34,613	34,621	34,624	34,629	34,633	34,638	34,643	34,647	34,651	34,656	
Santa Clara	120,110	120,163	120,192	120,194	120,223	120,254	120,284	120,314	120,345	120,374	120,404	
Santa Cruz	16,241	16,246	16,246	16,246	16,250	16,255	16,260	16,265	16,270	16,275	16,280	
Solano	33,735	33,762	33,780	33,797	33,815	33,833	33,851	33,869	33,887	33,905	33,923	
Sonoma	30,876	30,884	30,957	30,974	31,004	31,033	31,063	31,093	31,123	31,154	31,184	
Ventura	81,650	81,661	81,694	81,727	81,741	81,754	81,767	81,781	81,794	81,807	81,820	

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:											
	6/20	6/21	6/22	6/23	6/25			6/27			6/29					
Alameda	89,626	89,659	89,756	89,819	89,901	(17,980)	[4,315]	{2,158}	89,984	(17,997)	[4,319]	{2,160}	90,071	(18,014)	[4,323]	{2,162}
Contra Costa	70,646	70,730	70,770	70,818	70,928	(14,186)	[3,405]	{1,702}	71,043	(14,209)	[3,410]	{1,705}	71,159	(14,232)	[3,416]	{1,708}
Fresno	102,922	102,947	102,971	102,996	103,038	(20,608)	[4,946]	{2,473}	103,080	(20,616)	[4,948]	{2,474}	103,122	(20,624)	[4,950]	{2,475}
Kern	110,782	110,799	110,823	110,847	110,884	(22,177)	[5,322]	{2,661}	110,919	(22,184)	[5,324]	{2,662}	110,953	(22,191)	[5,326]	{2,663}
Lake	3,563	3,564	3,564	3,564	3,566	(713)	[171]	{86}	3,569	(714)	[171]	{86}	3,571	(714)	[171]	{86}
Los Angeles	1,247,618	1,247,744	1,247,909	1,248,161	1,248,540	(249,708)	[59,930]	{29,965}	1,248,915	(249,783)	[59,948]	{29,974}	1,249,290	(249,858)	[59,966]	{29,983}
Marin	14,203	14,206	14,208	14,207	14,214	(2,843)	[682]	{341}	14,220	(2,844)	[683]	{341}	14,227	(2,845)	[683]	{341}
Monterey	43,835	43,836	43,842	43,842	43,849	(8,770)	[2,105]	{1,052}	43,856	(8,771)	[2,105]	{1,053}	43,863	(8,773)	[2,105]	{1,053}
Orange	273,012	273,057	273,105	273,128	273,204	(54,641)	[13,114]	{6,557}	273,278	(54,656)	[13,117]	{6,559}	273,350	(54,670)	[13,121]	{6,560}
Placer	23,537	23,589	23,604	23,633	23,690	(4,738)	[1,137]	{569}	23,747	(4,749)	[1,140]	{570}	23,806	(4,761)	[1,143]	{571}
Riverside	301,636	301,668	301,799	301,799	301,895	(60,379)	[14,491]	{7,245}	301,992	(60,398)	[14,496]	{7,248}	302,093	(60,419)	[14,500]	{7,250}
Sacramento	107,730	107,821	107,872	107,913	107,997	(21,599)	[5,184]	{2,592}	108,079	(21,616)	[5,188]	{2,594}	108,156	(21,631)	[5,191]	{2,596}
San Bernardino	299,289	299,305	299,320	299,372	299,441	(59,888)	[14,373]	{7,187}	299,511	(59,902)	[14,377]	{7,188}	299,578	(59,916)	[14,380]	{7,190}
San Diego	281,749	281,810	281,886	281,936	282,061	(56,412)	[13,539]	{6,769}	282,188	(56,438)	[13,545]	{6,773}	282,310	(56,462)	[13,551]	{6,775}
San Francisco	37,256	37,269	37,275	37,287	37,306	(7,461)	[1,791]	{895}	37,325	(7,465)	[1,792]	{896}	37,343	(7,469)	[1,792]	{896}
San Joaquin	74,707	74,727	74,808	74,808	74,880	(14,976)	[3,594]	{1,797}	74,956	(14,991)	[3,598]	{1,799}	75,031	(15,006)	[3,601]	{1,801}
San Luis Obispo	21,440	21,444	21,448	21,448	21,455	(4,291)	[1,030]	{515}	21,462	(4,292)	[1,030]	{515}	21,468	(4,294)	[1,030]	{515}
San Mateo	42,646	42,681	42,685	42,725	42,763	(8,553)	[2,053]	{1,026}	42,801	(8,560)	[2,054]	{1,027}	42,840	(8,568)	[2,056]	{1,028}
Santa Barbara	34,605	34,613	34,621	34,624	34,633	(6,927)	[1,662]	{831}	34,643	(6,929)	[1,663]	{831}	34,651	(6,930)	[1,663]	{832}
Santa Clara	120,110	120,163	120,192	120,194	120,254	(24,051)	[5,772]	{2,886}	120,314	(24,063)	[5,775]	{2,888}	120,374	(24,075)	[5,778]	{2,889}
Santa Cruz	16,241	16,246	16,246	16,246	16,255	(3,251)	[780]	{390}	16,265	(3,253)	[781]	{390}	16,275	(3,255)	[781]	{391}
Solano	33,735	33,762	33,780	33,797	33,833	(6,767)	[1,624]	{812}	33,869	(6,774)	[1,626]	{813}	33,905	(6,781)	[1,627]	{814}
Sonoma	30,876	30,884	30,957	30,974	31,033	(6,207)	[1,490]	{745}	31,093	(6,219)	[1,492]	{746}	31,154	(6,231)	[1,495]	{748}
Ventura	81,650	81,661	81,694	81,727	81,754	(16,351)	[3,924]	{1,962}	81,781	(16,356)	[3,925]	{1,963}	81,807	(16,361)	[3,927]	{1,963}

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.