

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

Date: 3/30/21

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 3/30/21 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.

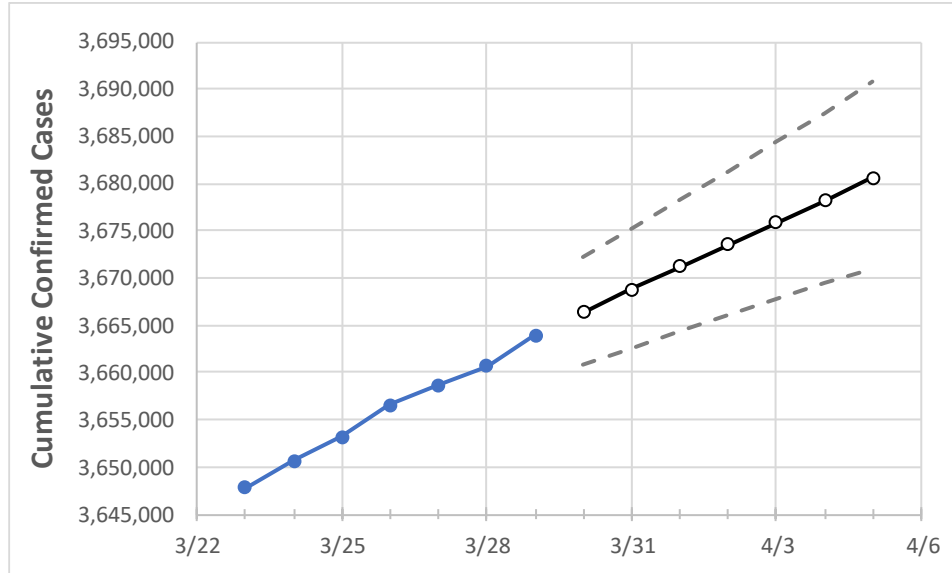
IEM's Modeling Lead

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:					
	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	
California	3,656,610	3,658,714	3,660,713	3,663,913	3,666,401	3,668,853	3,671,256	3,673,577	3,675,908	3,678,238	3,680,609	

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:						
	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5
Alameda	82,945	83,043	83,169	83,243	83,318	83,393	83,468	83,540	83,616	83,688	83,762
Contra Costa	64,961	65,065	65,140	65,230	65,300	65,371	65,440	65,511	65,578	65,646	65,711
Fresno	98,602	98,731	98,901	99,004	99,111	99,216	99,321	99,426	99,531	99,638	99,743
Kern	105,912	105,994	106,074	106,127	106,201	106,273	106,345	106,416	106,486	106,552	106,619
Lake	3,312	3,314	3,317	3,320	3,327	3,334	3,340	3,347	3,354	3,362	3,369
Los Angeles	1,217,116	1,217,775	1,218,229	1,218,643	1,219,034	1,219,412	1,219,773	1,220,120	1,220,454	1,220,754	1,221,057
Marin	13,635	13,646	13,657	13,664	13,679	13,694	13,709	13,724	13,739	13,755	13,770
Monterey	42,868	42,890	42,890	42,890	42,913	42,936	42,960	42,983	43,005	43,028	43,051
Orange	265,536	265,653	265,787	265,926	266,058	266,193	266,318	266,446	266,575	266,705	266,826
Placer	20,736	20,787	20,837	20,888	20,931	20,975	21,019	21,065	21,113	21,159	21,208
Riverside	293,831	293,908	293,986	294,063	294,165	294,268	294,368	294,465	294,563	294,655	294,749
Sacramento	96,990	97,040	97,247	97,481	97,652	97,826	98,004	98,182	98,364	98,548	98,735
San Bernardino	290,315	290,505	290,630	290,715	290,837	290,961	291,079	291,194	291,311	291,428	291,543
San Diego	269,049	269,275	269,480	269,770	270,026	270,285	270,541	270,788	271,033	271,278	271,514
San Francisco	35,154	35,186	35,244	35,286	35,321	35,355	35,390	35,425	35,461	35,498	35,534
San Joaquin	69,448	69,482	69,516	69,550	69,634	69,713	69,796	69,884	69,964	70,042	70,121
San Luis Obispo	20,402	20,412	20,423	20,433	20,453	20,474	20,496	20,515	20,535	20,555	20,575
San Mateo	40,147	40,199	40,264	40,305	40,341	40,378	40,414	40,449	40,484	40,519	40,553
Santa Barbara	33,020	33,045	33,077	33,105	33,135	33,164	33,191	33,220	33,247	33,275	33,304
Santa Clara	114,015	114,183	114,294	114,398	114,500	114,596	114,691	114,785	114,879	114,972	115,061
Santa Cruz	15,306	15,322	15,338	15,354	15,368	15,382	15,395	15,409	15,422	15,434	15,446
Solano	31,009	31,046	31,084	31,121	31,164	31,207	31,251	31,296	31,342	31,389	31,436
Sonoma	29,122	29,169	29,199	29,219	29,244	29,270	29,295	29,321	29,345	29,369	29,392
Ventura	79,472	79,511	79,549	79,588	79,633	79,680	79,726	79,771	79,813	79,855	79,898

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:											
	3/26	3/27	3/28	3/29	3/31				4/2				4/4			
Alameda	82,945	83,043	83,169	83,243	83,393	(16,679)	[4,003]	{2,001}	83,540	(16,708)	[4,010]	{2,005}	83,688	(16,738)	[4,017]	{2,009}
Contra Costa	64,961	65,065	65,140	65,230	65,371	(13,074)	[3,138]	{1,569}	65,511	(13,102)	[3,145]	{1,572}	65,646	(13,129)	[3,151]	{1,575}
Fresno	98,602	98,731	98,901	99,004	99,216	(19,843)	[4,762]	{2,381}	99,426	(19,885)	[4,772]	{2,386}	99,638	(19,928)	[4,783]	{2,391}
Kern	105,912	105,994	106,074	106,127	106,273	(21,255)	[5,101]	{2,551}	106,416	(21,283)	[5,108]	{2,554}	106,552	(21,310)	[5,115]	{2,557}
Lake	3,312	3,314	3,317	3,320	3,334	(667)	[160]	{80}	3,347	(669)	[161]	{80}	3,362	(672)	[161]	{81}
Los Angeles	1,217,116	1,217,775	1,218,229	1,218,643	1,219,412	(243,882)	[58,532]	{29,266}	1,220,120	(244,024)	[58,566]	{29,283}	1,220,754	(244,151)	[58,596]	{29,298}
Marin	13,635	13,646	13,657	13,664	13,694	(2,739)	[657]	{329}	13,724	(2,745)	[659]	{329}	13,755	(2,751)	[660]	{330}
Monterey	42,868	42,890	42,890	42,890	42,936	(8,587)	[2,061]	{1,030}	42,983	(8,597)	[2,063]	{1,032}	43,028	(8,606)	[2,065]	{1,033}
Orange	265,536	265,653	265,787	265,926	266,193	(53,239)	[12,777]	{6,389}	266,446	(53,289)	[12,789]	{6,395}	266,705	(53,341)	[12,802]	{6,401}
Placer	20,736	20,787	20,837	20,888	20,975	(4,195)	[1,007]	{503}	21,065	(4,213)	[1,011]	{506}	21,159	(4,232)	[1,016]	{508}
Riverside	293,831	293,908	293,986	294,063	294,268	(58,854)	[14,125]	{7,062}	294,465	(58,893)	[14,134]	{7,067}	294,655	(58,931)	[14,143]	{7,072}
Sacramento	96,990	97,040	97,247	97,481	97,826	(19,565)	[4,696]	{2,348}	98,182	(19,636)	[4,713]	{2,356}	98,548	(19,710)	[4,730]	{2,365}
San Bernardino	290,315	290,505	290,630	290,715	290,961	(58,192)	[13,966]	{6,983}	291,194	(58,239)	[13,977]	{6,989}	291,428	(58,286)	[13,989]	{6,994}
San Diego	269,049	269,275	269,480	269,770	270,285	(54,057)	[12,974]	{6,487}	270,788	(54,158)	[12,998]	{6,499}	271,278	(54,256)	[13,021]	{6,511}
San Francisco	35,154	35,186	35,244	35,286	35,355	(7,071)	[1,697]	{849}	35,425	(7,085)	[1,700]	{850}	35,498	(7,100)	[1,704]	{852}
San Joaquin	69,448	69,482	69,516	69,550	69,713	(13,943)	[3,346]	{1,673}	69,884	(13,977)	[3,354]	{1,677}	70,042	(14,008)	[3,362]	{1,681}
San Luis Obispo	20,402	20,412	20,423	20,433	20,474	(4,095)	[983]	{491}	20,515	(4,103)	[985]	{492}	20,555	(4,111)	[987]	{493}
San Mateo	40,147	40,199	40,264	40,305	40,378	(8,076)	[1,938]	{969}	40,449	(8,090)	[1,942]	{971}	40,519	(8,104)	[1,945]	{972}
Santa Barbara	33,020	33,045	33,077	33,105	33,164	(6,633)	[1,592]	{796}	33,220	(6,644)	[1,595]	{797}	33,275	(6,655)	[1,597]	{799}
Santa Clara	114,015	114,183	114,294	114,398	114,596	(22,919)	[5,501]	{2,750}	114,785	(22,957)	[5,510]	{2,755}	114,972	(22,994)	[5,519]	{2,759}
Santa Cruz	15,306	15,322	15,338	15,354	15,382	(3,076)	[738]	{369}	15,409	(3,082)	[740]	{370}	15,434	(3,087)	[741]	{370}
Solano	31,009	31,046	31,084	31,121	31,207	(6,241)	[1,498]	{749}	31,296	(6,259)	[1,502]	{751}	31,389	(6,278)	[1,507]	{753}
Sonoma	29,122	29,169	29,199	29,219	29,270	(5,854)	[1,405]	{702}	29,321	(5,864)	[1,407]	{704}	29,369	(5,874)	[1,410]	{705}
Ventura	79,472	79,511	79,549	79,588	79,680	(15,936)	[3,825]	{1,912}	79,771	(15,954)	[3,829]	{1,914}	79,855	(15,971)	[3,833]	{1,917}

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.