

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

Date: 3/9/21

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 3/9/21 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.

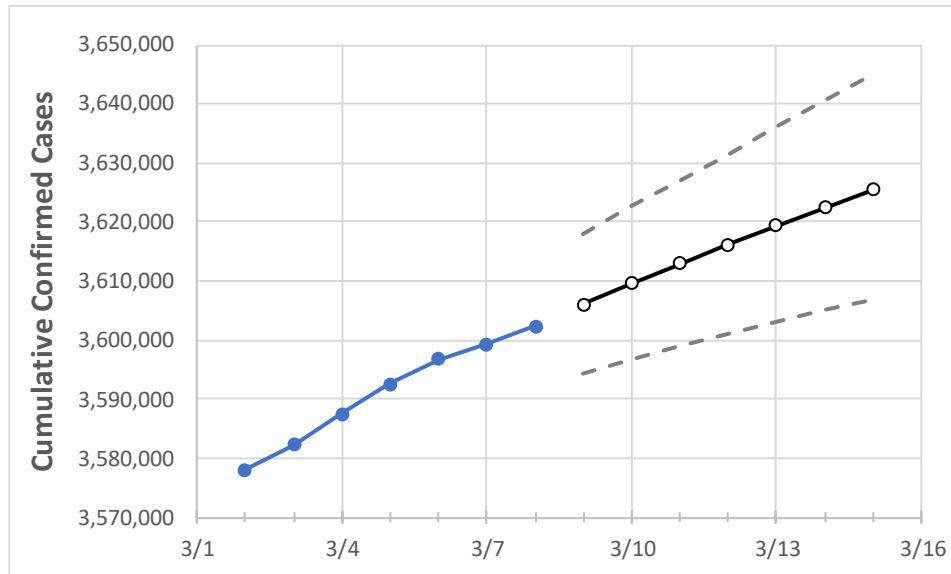
IEM's Modeling Lead

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:						
	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15
California	3,592,560	3,596,760	3,599,250	3,602,380	3,606,015	3,609,566	3,612,939	3,616,254	3,619,401	3,622,497	3,625,560

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:						
	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15
Alameda	81,168	81,255	81,345	81,433	81,528	81,617	81,704	81,790	81,870	81,948	82,023
Contra Costa	63,142	63,297	63,349	63,400	63,500	63,599	63,697	63,789	63,882	63,972	64,059
Fresno	96,023	96,184	96,366	96,549	96,687	96,824	96,962	97,092	97,221	97,352	97,483
Kern	104,057	104,181	104,212	104,242	104,359	104,470	104,576	104,674	104,773	104,867	104,958
Lake	3,181	3,185	3,189	3,192	3,196	3,199	3,203	3,206	3,209	3,212	3,215
Los Angeles	1,200,128	1,201,868	1,203,152	1,204,018	1,205,342	1,206,639	1,207,902	1,209,180	1,210,406	1,211,592	1,212,766
Marin	13,337	13,358	13,363	13,368	13,386	13,405	13,423	13,440	13,456	13,473	13,489
Monterey	42,373	42,404	42,404	42,404	42,425	42,444	42,461	42,477	42,493	42,509	42,522
Orange	262,241	262,550	262,674	262,849	263,029	263,203	263,364	263,521	263,674	263,822	263,967
Placer	20,035	20,077	20,120	20,162	20,207	20,251	20,297	20,345	20,391	20,441	20,490
Riverside	290,904	290,949	290,995	291,040	291,172	291,290	291,400	291,500	291,611	291,705	291,797
Sacramento	94,129	94,182	94,332	94,513	94,624	94,729	94,833	94,931	95,030	95,128	95,219
San Bernardino	287,513	287,782	287,867	288,044	288,216	288,386	288,546	288,699	288,847	288,989	289,132
San Diego	262,360	262,781	262,875	262,968	263,257	263,535	263,800	264,053	264,294	264,534	264,757
San Francisco	34,480	34,526	34,560	34,594	34,630	34,667	34,701	34,734	34,766	34,797	34,827
San Joaquin	67,284	67,284	67,284	67,284	67,354	67,422	67,487	67,557	67,619	67,682	67,742
San Luis Obispo	19,835	19,835	19,835	19,835	19,857	19,877	19,896	19,914	19,932	19,948	19,965
San Mateo	39,225	39,305	39,384	39,436	39,485	39,532	39,576	39,620	39,662	39,704	39,742
Santa Barbara	32,267	32,301	32,324	32,347	32,390	32,432	32,473	32,511	32,547	32,582	32,617
Santa Clara	111,460	111,638	111,814	111,952	112,112	112,265	112,411	112,555	112,694	112,830	112,960
Santa Cruz	14,790	14,790	14,790	14,790	14,813	14,837	14,862	14,885	14,909	14,933	14,956
Solano	30,305	30,338	30,371	30,404	30,439	30,474	30,509	30,543	30,576	30,608	30,641
Sonoma	28,379	28,417	28,484	28,533	28,580	28,627	28,674	28,718	28,762	28,806	28,847
Ventura	78,184	78,368	78,439	78,487	78,578	78,668	78,754	78,835	78,914	78,989	79,062

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:											
	3/5	3/6	3/7	3/8	3/10				3/12				3/14			
Alameda	81,168	81,255	81,345	81,433	81,617	(16,323)	[3,918]	{1,959}	81,790	(16,358)	[3,926]	{1,963}	81,948	(16,390)	[3,934]	{1,967}
Contra Costa	63,142	63,297	63,349	63,400	63,599	(12,720)	[3,053]	{1,526}	63,789	(12,758)	[3,062]	{1,531}	63,972	(12,794)	[3,071]	{1,535}
Fresno	96,023	96,184	96,366	96,549	96,824	(19,365)	[4,648]	{2,324}	97,092	(19,418)	[4,660]	{2,330}	97,352	(19,470)	[4,673]	{2,336}
Kern	104,057	104,181	104,212	104,242	104,470	(20,894)	[5,015]	{2,507}	104,674	(20,935)	[5,024]	{2,512}	104,867	(20,973)	[5,034]	{2,517}
Lake	3,181	3,185	3,189	3,192	3,199	(640)	[154]	{77}	3,206	(641)	[154]	{77}	3,212	(642)	[154]	{77}
Los Angeles	1,200,128	1,201,868	1,203,152	1,204,018	1,206,639	(241,328)	[57,919]	{28,959}	1,209,180	(241,836)	[58,041]	{29,020}	1,211,592	(242,318)	[58,156]	{29,078}
Marin	13,337	13,358	13,363	13,368	13,405	(2,681)	[643]	{322}	13,440	(2,688)	[645]	{323}	13,473	(2,695)	[647]	{323}
Monterey	42,373	42,404	42,404	42,404	42,444	(8,489)	[2,037]	{1,019}	42,477	(8,495)	[2,039]	{1,019}	42,509	(8,502)	[2,040]	{1,020}
Orange	262,241	262,550	262,674	262,849	263,203	(52,641)	[12,634]	{6,317}	263,521	(52,704)	[12,649]	{6,325}	263,822	(52,764)	[12,663]	{6,332}
Placer	20,035	20,077	20,120	20,162	20,251	(4,050)	[972]	{486}	20,345	(4,069)	[977]	{488}	20,441	(4,088)	[981]	{491}
Riverside	290,904	290,949	290,995	291,040	291,290	(58,258)	[13,982]	{6,991}	291,500	(58,300)	[13,992]	{6,996}	291,705	(58,341)	[14,002]	{7,001}
Sacramento	94,129	94,182	94,332	94,513	94,729	(18,946)	[4,547]	{2,274}	94,931	(18,986)	[4,557]	{2,278}	95,128	(19,026)	[4,566]	{2,283}
San Bernardino	287,513	287,782	287,867	288,044	288,386	(57,677)	[13,843]	{6,921}	288,699	(57,740)	[13,858]	{6,929}	288,989	(57,798)	[13,871]	{6,936}
San Diego	262,360	262,781	262,875	262,968	263,535	(52,707)	[12,650]	{6,325}	264,053	(52,811)	[12,675]	{6,337}	264,534	(52,907)	[12,698]	{6,349}
San Francisco	34,480	34,526	34,560	34,594	34,667	(6,933)	[1,664]	{832}	34,734	(6,947)	[1,667]	{834}	34,797	(6,959)	[1,670]	{835}
San Joaquin	67,284	67,284	67,284	67,284	67,422	(13,484)	[3,236]	{1,618}	67,557	(13,511)	[3,243]	{1,621}	67,682	(13,536)	[3,249]	{1,624}
San Luis Obispo	19,835	19,835	19,835	19,835	19,877	(3,975)	[954]	{477}	19,914	(3,983)	[956]	{478}	19,948	(3,990)	[958]	{479}
San Mateo	39,225	39,305	39,384	39,436	39,532	(7,906)	[1,898]	{949}	39,620	(7,924)	[1,902]	{951}	39,704	(7,941)	[1,906]	{953}
Santa Barbara	32,267	32,301	32,324	32,347	32,432	(6,486)	[1,557]	{778}	32,511	(6,502)	[1,561]	{780}	32,582	(6,516)	[1,564]	{782}
Santa Clara	111,460	111,638	111,814	111,952	112,265	(22,453)	[5,389]	{2,694}	112,555	(22,511)	[5,403]	{2,701}	112,830	(22,566)	[5,416]	{2,708}
Santa Cruz	14,790	14,790	14,790	14,790	14,837	(2,967)	[712]	{356}	14,885	(2,977)	[714]	{357}	14,933	(2,987)	[717]	{358}
Solano	30,305	30,338	30,371	30,404	30,474	(6,095)	[1,463]	{731}	30,543	(6,109)	[1,466]	{733}	30,608	(6,122)	[1,469]	{735}
Sonoma	28,379	28,417	28,484	28,533	28,627	(5,725)	[1,374]	{687}	28,718	(5,744)	[1,378]	{689}	28,806	(5,761)	[1,383]	{691}
Ventura	78,184	78,368	78,439	78,487	78,668	(15,734)	[3,776]	{1,888}	78,835	(15,767)	[3,784]	{1,892}	78,989	(15,798)	[3,791]	{1,896}

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.