

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

Date: 2/16/21

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 2/16/21 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.

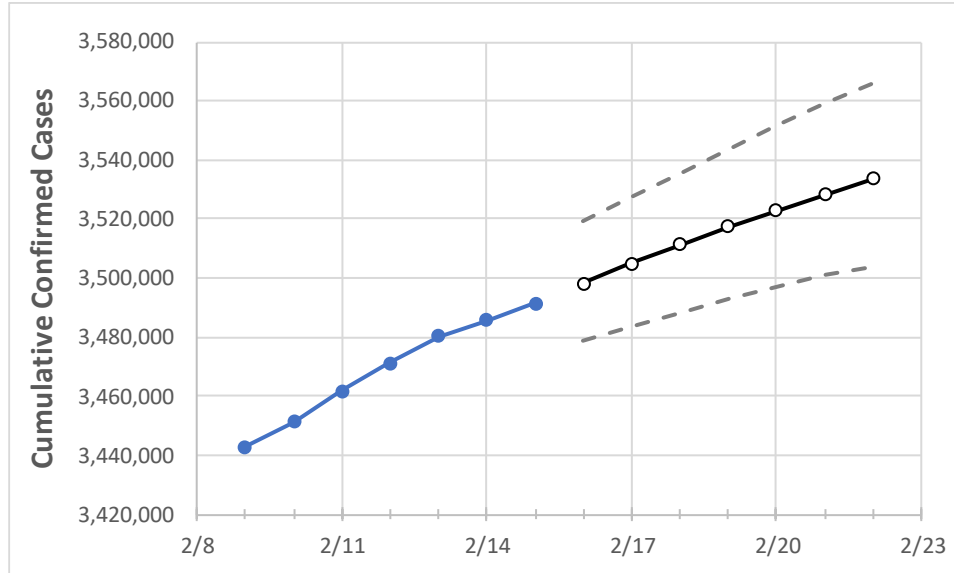
IEM's Modeling Lead

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22

California	3,471,311	3,480,228	3,485,841	3,491,392	3,498,308	3,504,972	3,511,347	3,517,333	3,523,005	3,528,421	3,533,489
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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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Alameda	77,926	78,285	78,356	78,714	79,144	79,566	79,984	80,392	80,787	81,179	81,546
Contra Costa	60,142	60,365	60,537	60,710	60,883	61,051	61,214	61,375	61,533	61,684	61,825
Fresno	92,168	92,520	92,807	93,065	93,293	93,512	93,716	93,918	94,115	94,304	94,487
Kern	99,570	100,025	100,290	100,434	100,769	101,093	101,416	101,720	102,026	102,326	102,613
Lake	3,002	3,012	3,025	3,030	3,041	3,052	3,064	3,075	3,085	3,095	3,105
Los Angeles	1,161,926	1,164,880	1,166,552	1,168,372	1,170,459	1,172,439	1,174,315	1,176,092	1,177,752	1,179,356	1,180,884
Marin	12,795	12,823	12,843	12,876	12,904	12,931	12,957	12,983	13,008	13,033	13,056
Monterey	41,246	41,341	41,341	41,341	41,440	41,526	41,606	41,686	41,761	41,831	41,897
Orange	255,882	256,510	256,889	256,889	257,495	258,074	258,642	259,189	259,709	260,237	260,734
Placer	19,188	19,201	19,214	19,313	19,353	19,391	19,426	19,460	19,493	19,528	19,558
Riverside	285,414	285,414	285,414	285,414	285,926	286,408	286,883	287,316	287,739	288,132	288,500
Sacramento	89,988	90,252	90,401	90,856	91,091	91,328	91,553	91,771	91,989	92,200	92,378
San Bernardino	280,949	281,604	282,169	282,494	282,833	283,153	283,453	283,742	284,021	284,296	284,539
San Diego	250,791	251,682	252,250	252,943	253,653	254,314	254,963	255,594	256,194	256,776	257,324
San Francisco	33,076	33,179	33,291	33,374	33,474	33,569	33,665	33,756	33,843	33,932	34,018
San Joaquin	64,969	64,969	64,969	64,969	65,159	65,343	65,528	65,709	65,882	66,047	66,217
San Luis Obispo	18,899	18,889	18,889	18,889	18,946	19,001	19,050	19,098	19,142	19,186	19,228
San Mateo	37,548	37,621	37,745	37,859	37,958	38,053	38,143	38,229	38,310	38,388	38,463
Santa Barbara	30,586	30,728	30,862	30,862	30,979	31,089	31,201	31,304	31,403	31,500	31,590
Santa Clara	106,749	107,110	107,397	107,619	107,893	108,158	108,410	108,657	108,894	109,117	109,327
Santa Cruz	14,232	14,232	14,232	14,232	14,278	14,321	14,364	14,407	14,445	14,486	14,525
Solano	29,251	29,251	29,251	29,251	29,325	29,398	29,469	29,539	29,603	29,665	29,732
Sonoma	27,133	27,143	27,249	27,361	27,420	27,479	27,534	27,590	27,641	27,688	27,732
Ventura	74,959	75,210	75,481	75,742	75,987	76,226	76,451	76,667	76,875	77,074	77,260

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:											
	2/12	2/13	2/14	2/15	2/17			2/19			2/21					
Alameda	77,926	78,285	78,356	78,714	79,566	(15,913)	[3,819]	{1,910}	80,392	(16,078)	[3,859]	{1,929}	81,179	(16,236)	[3,897]	{1,948}
Contra Costa	60,142	60,365	60,537	60,710	61,051	(12,210)	[2,930]	{1,465}	61,375	(12,275)	[2,946]	{1,473}	61,684	(12,337)	[2,961]	{1,480}
Fresno	92,168	92,520	92,807	93,065	93,512	(18,702)	[4,489]	{2,244}	93,918	(18,784)	[4,508]	{2,254}	94,304	(18,861)	[4,527]	{2,263}
Kern	99,570	100,025	100,290	100,434	101,093	(20,219)	[4,852]	{2,426}	101,720	(20,344)	[4,883]	{2,441}	102,326	(20,465)	[4,912]	{2,456}
Lake	3,002	3,012	3,025	3,030	3,052	(610)	[147]	{73}	3,075	(615)	[148]	{74}	3,095	(619)	[149]	{74}
Los Angeles	1,161,926	1,164,880	1,166,552	1,168,372	1,172,439	(234,488)	[56,277]	{28,139}	1,176,092	(235,218)	[56,452]	{28,226}	1,179,356	(235,871)	[56,609]	{28,305}
Marin	12,795	12,823	12,843	12,876	12,931	(2,586)	[621]	{310}	12,983	(2,597)	[623]	{312}	13,033	(2,607)	[626]	{313}
Monterey	41,246	41,341	41,341	41,341	41,526	(8,305)	[1,993]	{997}	41,686	(8,337)	[2,001]	{1,000}	41,831	(8,366)	[2,008]	{1,004}
Orange	255,882	256,510	256,889	256,889	258,074	(51,615)	[12,388]	{6,194}	259,189	(51,838)	[12,441]	{6,221}	260,237	(52,047)	[12,491]	{6,246}
Placer	19,188	19,201	19,214	19,313	19,391	(3,878)	[931]	{465}	19,460	(3,892)	[934]	{467}	19,528	(3,906)	[937]	{469}
Riverside	285,414	285,414	285,414	285,414	286,408	(57,282)	[13,748]	{6,874}	287,316	(57,463)	[13,791]	{6,896}	288,132	(57,626)	[13,830]	{6,915}
Sacramento	89,988	90,252	90,401	90,856	91,328	(18,266)	[4,384]	{2,192}	91,771	(18,354)	[4,405]	{2,202}	92,200	(18,440)	[4,426]	{2,213}
San Bernardino	280,949	281,604	282,169	282,494	283,153	(56,631)	[13,591]	{6,796}	283,742	(56,748)	[13,620]	{6,810}	284,296	(56,859)	[13,646]	{6,823}
San Diego	250,791	251,682	252,250	252,943	254,314	(50,863)	[12,207]	{6,104}	255,594	(51,119)	[12,268]	{6,134}	256,776	(51,355)	[12,325]	{6,163}
San Francisco	33,076	33,179	33,291	33,374	33,569	(6,714)	[1,611]	{806}	33,756	(6,751)	[1,620]	{810}	33,932	(6,786)	[1,629]	{814}
San Joaquin	64,969	64,969	64,969	64,969	65,343	(13,069)	[3,136]	{1,568}	65,709	(13,142)	[3,154]	{1,577}	66,047	(13,209)	[3,170]	{1,585}
San Luis Obispo	18,899	18,889	18,889	18,889	19,001	(3,800)	[912]	{456}	19,098	(3,820)	[917]	{458}	19,186	(3,837)	[921]	{460}
San Mateo	37,548	37,621	37,745	37,859	38,053	(7,611)	[1,827]	{913}	38,229	(7,646)	[1,835]	{918}	38,388	(7,678)	[1,843]	{921}
Santa Barbara	30,586	30,728	30,862	30,862	31,089	(6,218)	[1,492]	{746}	31,304	(6,261)	[1,503]	{751}	31,500	(6,300)	[1,512]	{756}
Santa Clara	106,749	107,110	107,397	107,619	108,158	(21,632)	[5,192]	{2,596}	108,657	(21,731)	[5,216]	{2,608}	109,117	(21,823)	[5,238]	{2,619}
Santa Cruz	14,232	14,232	14,232	14,232	14,321	(2,864)	[687]	{344}	14,407	(2,881)	[692]	{346}	14,486	(2,897)	[695]	{348}
Solano	29,251	29,251	29,251	29,251	29,398	(5,880)	[1,411]	{706}	29,539	(5,908)	[1,418]	{709}	29,665	(5,933)	[1,424]	{712}
Sonoma	27,133	27,143	27,249	27,361	27,479	(5,496)	[1,319]	{660}	27,590	(5,518)	[1,324]	{662}	27,688	(5,538)	[1,329]	{665}
Ventura	74,959	75,210	75,481	75,742	76,226	(15,245)	[3,659]	{1,829}	76,667	(15,333)	[3,680]	{1,840}	77,074	(15,415)	[3,700]	{1,850}

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.