

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

Date: 1/25/21

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 1/25/21 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.

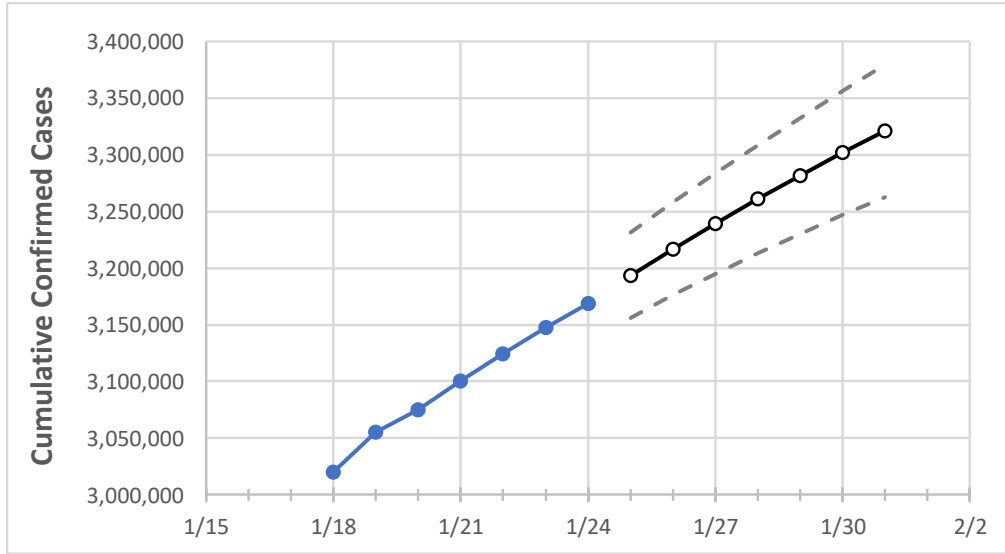
IEM's Modeling Lead

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
California	3,100,027	3,124,420	3,147,735	3,168,528	3,192,992	3,216,388	3,239,209	3,260,639	3,281,516	3,301,550	3,321,092

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Alameda	69,107	69,554	69,693	70,334	71,120	71,909	72,669	73,438	74,208	74,988	75,764
Contra Costa	53,844	54,140	54,416	54,951	55,430	55,899	56,361	56,825	57,264	57,723	58,152
Fresno	83,591	84,137	84,744	85,274	85,917	86,541	87,168	87,791	88,390	88,972	89,560
Kern	87,714	88,399	89,095	90,213	90,947	91,668	92,377	93,085	93,778	94,455	95,145
Lake	2,646	2,669	2,681	2,673	2,729	2,786	2,844	2,904	2,966	3,027	3,094
Los Angeles	1,046,591	1,054,802	1,065,505	1,073,156	1,082,494	1,091,461	1,100,386	1,108,949	1,117,324	1,125,602	1,133,600
Marin	11,810	11,899	11,930	11,954	12,027	12,099	12,169	12,240	12,309	12,378	12,444
Monterey	36,668	36,950	37,285	37,285	37,595	37,894	38,182	38,461	38,730	38,995	39,262
Orange	217,849	218,867	221,493	223,288	225,215	227,073	228,880	230,649	232,335	233,956	235,554
Placer	17,584	17,675	17,675	17,675	17,805	17,930	18,050	18,169	18,286	18,401	18,517
Riverside	255,808	258,532	258,532	258,532	261,887	265,319	268,805	272,081	275,612	279,116	282,742
Sacramento	81,687	82,303	82,861	83,408	84,088	84,749	85,396	86,043	86,663	87,290	87,883
San Bernardino	258,742	261,199	262,858	264,457	266,500	268,572	270,609	272,583	274,493	276,368	278,261
San Diego	219,731	222,578	225,558	227,195	229,394	231,495	233,527	235,517	237,486	239,400	241,253
San Francisco	29,665	29,801	30,027	30,308	30,539	30,767	30,996	31,224	31,443	31,651	31,862
San Joaquin	59,096	59,395	59,395	59,395	59,943	60,490	61,054	61,583	62,106	62,634	63,171
San Luis Obispo	16,228	16,437	16,545	16,652	16,833	17,011	17,184	17,361	17,530	17,700	17,858
San Mateo	33,207	33,468	33,731	33,731	34,094	34,453	34,804	35,152	35,495	35,828	36,164
Santa Barbara	25,751	25,986	26,514	26,820	27,211	27,616	28,021	28,410	28,807	29,199	29,598
Santa Clara	95,936	96,340	96,435	98,057	98,966	99,858	100,742	101,591	102,414	103,241	104,026
Santa Cruz	12,533	12,649	12,687	12,771	12,894	13,012	13,125	13,236	13,346	13,450	13,557
Solano	26,191	26,494	26,494	26,494	26,782	27,081	27,360	27,660	27,936	28,232	28,523
Sonoma	24,469	24,571	24,761	24,935	25,160	25,386	25,612	25,826	26,041	26,253	26,469
Ventura	63,608	63,995	64,404	65,581	66,486	67,364	68,260	69,153	70,027	70,877	71,676

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:											
	1/21	1/22	1/23	1/24	1/26				1/28				1/30			
Alameda	69,107	69,554	69,693	70,334	71,909	(14,382)	[3,452]	{1,726}	73,438	(14,688)	[3,525]	{1,763}	74,988	(14,998)	[3,599]	{1,800}
Contra Costa	53,844	54,140	54,416	54,951	55,899	(11,180)	[2,683]	{1,342}	56,825	(11,365)	[2,728]	{1,364}	57,723	(11,545)	[2,771]	{1,385}
Fresno	83,591	84,137	84,744	85,274	86,541	(17,308)	[4,154]	{2,077}	87,791	(17,558)	[4,214]	{2,107}	88,972	(17,794)	[4,271]	{2,135}
Kern	87,714	88,399	89,095	90,213	91,668	(18,334)	[4,400]	{2,200}	93,085	(18,617)	[4,468]	{2,234}	94,455	(18,891)	[4,534]	{2,267}
Lake	2,646	2,669	2,681	2,673	2,786	(557)	[134]	{67}	2,904	(581)	[139]	{70}	3,027	(605)	[145]	{73}
Los Angeles	1,046,591	1,054,802	1,065,505	1,073,156	1,091,461	(218,292)	[52,390]	{26,195}	1,108,949	(221,790)	[53,230]	{26,615}	1,125,602	(225,120)	[54,029]	{27,014}
Marin	11,810	11,899	11,930	11,954	12,099	(2,420)	[581]	{290}	12,240	(2,448)	[588]	{294}	12,378	(2,476)	[594]	{297}
Monterey	36,668	36,950	37,285	37,285	37,894	(7,579)	[1,819]	{909}	38,461	(7,692)	[1,846]	{923}	38,995	(7,799)	[1,872]	{936}
Orange	217,849	218,867	221,493	223,288	227,073	(45,415)	[10,900]	{5,450}	230,649	(46,130)	[11,071]	{5,536}	233,956	(46,791)	[11,230]	{5,615}
Placer	17,584	17,675	17,675	17,675	17,930	(3,586)	[861]	{430}	18,169	(3,634)	[872]	{436}	18,401	(3,680)	[883]	{442}
Riverside	255,808	258,532	258,532	258,532	265,319	(53,064)	[12,735]	{6,368}	272,081	(54,416)	[13,060]	{6,530}	279,116	(55,823)	[13,398]	{6,699}
Sacramento	81,687	82,303	82,861	83,408	84,749	(16,950)	[4,068]	{2,034}	86,043	(17,209)	[4,130]	{2,065}	87,290	(17,458)	[4,190]	{2,095}
San Bernardino	258,742	261,199	262,858	264,457	268,572	(53,714)	[12,891]	{6,446}	272,583	(54,517)	[13,084]	{6,542}	276,368	(55,274)	[13,266]	{6,633}
San Diego	219,731	222,578	225,558	227,195	231,495	(46,299)	[11,112]	{5,556}	235,517	(47,103)	[11,305]	{5,652}	239,400	(47,880)	[11,491]	{5,746}
San Francisco	29,665	29,801	30,027	30,308	30,767	(6,153)	[1,477]	{738}	31,224	(6,245)	[1,499]	{749}	31,651	(6,330)	[1,519]	{760}
San Joaquin	59,096	59,395	59,395	59,395	60,490	(12,098)	[2,904]	{1,452}	61,583	(12,317)	[2,956]	{1,478}	62,634	(12,527)	[3,006]	{1,503}
San Luis Obispo	16,228	16,437	16,545	16,652	17,011	(3,402)	[817]	{408}	17,361	(3,472)	[833]	{417}	17,700	(3,540)	[850]	{425}
San Mateo	33,207	33,468	33,731	33,731	34,453	(6,891)	[1,654]	{827}	35,152	(7,030)	[1,687]	{844}	35,828	(7,166)	[1,720]	{860}
Santa Barbara	25,751	25,986	26,514	26,820	27,616	(5,523)	[1,326]	{663}	28,410	(5,682)	[1,364]	{682}	29,199	(5,840)	[1,402]	{701}
Santa Clara	95,936	96,340	96,435	98,057	99,858	(19,972)	[4,793]	{2,397}	101,591	(20,318)	[4,876]	{2,438}	103,241	(20,648)	[4,956]	{2,478}
Santa Cruz	12,533	12,649	12,687	12,771	13,012	(2,602)	[625]	{312}	13,236	(2,647)	[635]	{318}	13,450	(2,690)	[646]	{323}
Solano	26,191	26,494	26,494	26,494	27,081	(5,416)	[1,300]	{650}	27,660	(5,532)	[1,328]	{664}	28,232	(5,646)	[1,355]	{678}
Sonoma	24,469	24,571	24,761	24,935	25,386	(5,077)	[1,219]	{609}	25,826	(5,165)	[1,240]	{620}	26,253	(5,251)	[1,260]	{630}
Ventura	63,608	63,995	64,404	65,581	67,364	(13,473)	[3,233]	{1,617}	69,153	(13,831)	[3,319]	{1,660}	70,877	(14,175)	[3,402]	{1,701}

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.