

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 11/1/21**

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 11/1/21 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.

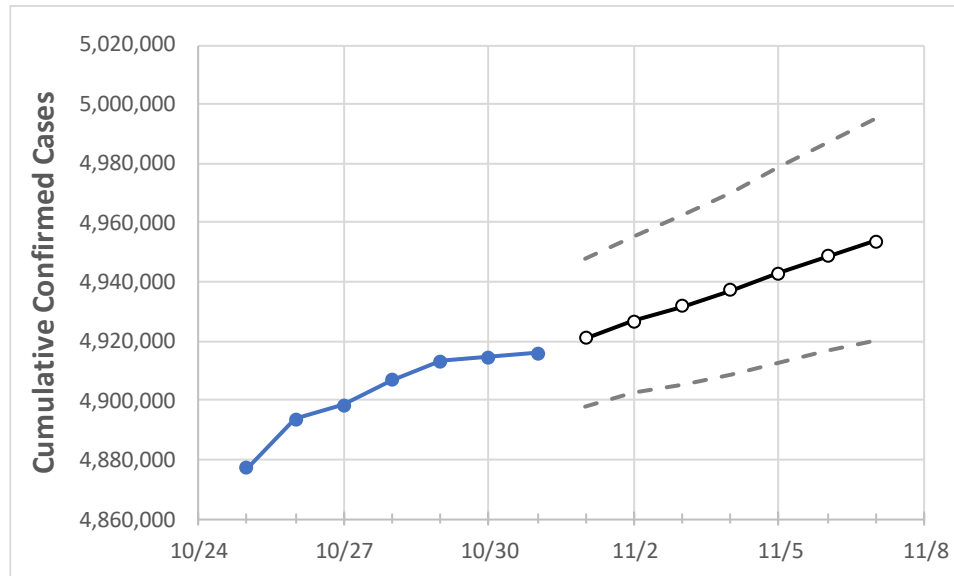
IEM's Modeling Lead

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:						
	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7
California	4,906,742	4,913,324	4,914,732	4,915,796	4,921,024	4,926,588	4,931,876	4,937,073	4,943,006	4,948,699	4,953,800

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:						
	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7
Alameda	121,397	121,542	121,542	121,542	121,651	121,761	121,872	121,980	122,091	122,205	122,313
Contra Costa	100,637	100,757	100,757	100,757	100,858	100,962	101,061	101,166	101,267	101,371	101,473
Fresno	148,484	148,938	148,938	148,938	149,306	149,684	150,073	150,452	150,847	151,246	151,641
Kern	148,507	148,990	148,990	148,990	149,385	149,781	150,180	150,576	150,989	151,406	151,818
Lake	6,735	6,756	6,756	6,756	6,774	6,792	6,810	6,829	6,848	6,866	6,885
Los Angeles	1,489,380	1,490,698	1,492,106	1,493,170	1,494,362	1,495,558	1,496,764	1,497,970	1,499,205	1,500,467	1,501,675
Marin	17,809	17,827	17,827	17,827	17,844	17,862	17,878	17,896	17,913	17,931	17,949
Monterey	51,149	51,188	51,188	51,188	51,228	51,268	51,308	51,349	51,393	51,437	51,478
Orange	325,921	326,246	326,246	326,246	326,517	326,792	327,062	327,329	327,616	327,896	328,171
Placer	39,972	40,076	40,076	40,076	40,171	40,270	40,366	40,463	40,564	40,665	40,770
Riverside	374,219	374,712	374,712	374,712	375,128	375,546	375,965	376,390	376,827	377,249	377,693
Sacramento	161,527	161,822	161,822	161,822	162,143	162,471	162,798	163,132	163,456	163,803	164,139
San Bernardino	360,817	361,269	361,269	361,269	361,639	362,013	362,385	362,775	363,165	363,555	363,953
San Diego	391,469	391,471	391,471	391,471	391,922	392,391	392,850	393,308	393,836	394,356	394,754
San Francisco	54,759	54,812	54,812	54,812	54,861	54,911	54,959	55,007	55,055	55,102	55,150
San Joaquin	103,580	103,726	103,726	103,726	103,865	103,994	104,130	104,270	104,400	104,538	104,675
San Luis Obispo	30,240	30,291	30,291	30,291	30,335	30,384	30,428	30,473	30,519	30,568	30,617
San Mateo	54,528	54,579	54,579	54,579	54,635	54,693	54,750	54,809	54,869	54,931	54,992
Santa Barbara	45,579	45,650	45,650	45,650	45,712	45,773	45,835	45,898	45,960	46,025	46,088
Santa Clara	146,378	146,559	146,559	146,559	146,707	146,851	146,994	147,140	147,290	147,439	147,588
Santa Cruz	21,168	21,211	21,211	21,211	21,236	21,261	21,286	21,312	21,338	21,365	21,391
Solano	46,303	46,360	46,360	46,360	46,398	46,437	46,474	46,513	46,550	46,587	46,624
Sonoma	41,358	41,453	41,453	41,453	41,513	41,577	41,634	41,699	41,762	41,828	41,893
Ventura	101,502	101,576	101,576	101,576	101,647	101,714	101,785	101,852	101,923	101,990	102,057

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:											
	10/28	10/29	10/30	10/31	11/2				11/4				11/6			
Alameda	121,397	121,542	121,542	121,542	121,761	(24,352)	[5,845]	{2,922}	121,980	(24,396)	[5,855]	{2,928}	122,205	(24,441)	[5,866]	{2,933}
Contra Costa	100,637	100,757	100,757	100,757	100,962	(20,192)	[4,846]	{2,423}	101,166	(20,233)	[4,856]	{2,428}	101,371	(20,274)	[4,866]	{2,433}
Fresno	148,484	148,938	148,938	148,938	149,684	(29,937)	[7,185]	{3,592}	150,452	(30,090)	[7,222]	{3,611}	151,246	(30,249)	[7,260]	{3,630}
Kern	148,507	148,990	148,990	148,990	149,781	(29,956)	[7,189]	{3,595}	150,576	(30,115)	[7,228]	{3,614}	151,406	(30,281)	[7,267]	{3,634}
Lake	6,735	6,756	6,756	6,756	6,792	(1,358)	[326]	{163}	6,829	(1,366)	[328]	{164}	6,866	(1,373)	[330]	{165}
Los Angeles	1,489,380	1,490,698	1,492,106	1,493,170	1,495,558	(299,112)	[71,787]	{35,893}	1,497,970	(299,594)	[71,903]	{35,951}	1,500,467	(300,093)	[72,022]	{36,011}
Marin	17,809	17,827	17,827	17,827	17,862	(3,572)	[857]	{429}	17,896	(3,579)	[859]	{429}	17,931	(3,586)	[861]	{430}
Monterey	51,149	51,188	51,188	51,188	51,268	(10,254)	[2,461]	{1,230}	51,349	(10,270)	[2,465]	{1,232}	51,437	(10,287)	[2,469]	{1,234}
Orange	325,921	326,246	326,246	326,246	326,792	(65,358)	[15,686]	{7,843}	327,329	(65,466)	[15,712]	{7,856}	327,896	(65,579)	[15,739]	{7,870}
Placer	39,972	40,076	40,076	40,076	40,270	(8,054)	[1,933]	{966}	40,463	(8,093)	[1,942]	{971}	40,665	(8,133)	[1,952]	{976}
Riverside	374,219	374,712	374,712	374,712	375,546	(75,109)	[18,026]	{9,013}	376,390	(75,278)	[18,067]	{9,033}	377,249	(75,450)	[18,108]	{9,054}
Sacramento	161,527	161,822	161,822	161,822	162,471	(32,494)	[7,799]	{3,899}	163,132	(32,626)	[7,830]	{3,915}	163,803	(32,761)	[7,863]	{3,931}
San Bernardino	360,817	361,269	361,269	361,269	362,013	(72,403)	[17,377]	{8,688}	362,775	(72,555)	[17,413]	{8,707}	363,555	(72,711)	[17,451]	{8,725}
San Diego	391,469	391,471	391,471	391,471	392,391	(78,478)	[18,835]	{9,417}	393,308	(78,662)	[18,879]	{9,439}	394,356	(78,871)	[18,929]	{9,465}
San Francisco	54,759	54,812	54,812	54,812	54,911	(10,982)	[2,636]	{1,318}	55,007	(11,001)	[2,640]	{1,320}	55,102	(11,020)	[2,645]	{1,322}
San Joaquin	103,580	103,726	103,726	103,726	103,994	(20,799)	[4,992]	{2,496}	104,270	(20,854)	[5,005]	{2,502}	104,538	(20,908)	[5,018]	{2,509}
San Luis Obispo	30,240	30,291	30,291	30,291	30,384	(6,077)	[1,458]	{729}	30,473	(6,095)	[1,463]	{731}	30,568	(6,114)	[1,467]	{734}
San Mateo	54,528	54,579	54,579	54,579	54,693	(10,939)	[2,625]	{1,313}	54,809	(10,962)	[2,631]	{1,315}	54,931	(10,986)	[2,637]	{1,318}
Santa Barbara	45,579	45,650	45,650	45,650	45,773	(9,155)	[2,197]	{1,099}	45,898	(9,180)	[2,203]	{1,102}	46,025	(9,205)	[2,209]	{1,105}
Santa Clara	146,378	146,559	146,559	146,559	146,851	(29,370)	[7,049]	{3,524}	147,140	(29,428)	[7,063]	{3,531}	147,439	(29,488)	[7,077]	{3,539}
Santa Cruz	21,168	21,211	21,211	21,211	21,261	(4,252)	[1,021]	{510}	21,312	(4,262)	[1,023]	{511}	21,365	(4,273)	[1,026]	{513}
Solano	46,303	46,360	46,360	46,360	46,437	(9,287)	[2,229]	{1,114}	46,513	(9,303)	[2,233]	{1,116}	46,587	(9,317)	[2,236]	{1,118}
Sonoma	41,358	41,453	41,453	41,453	41,577	(8,315)	[1,996]	{998}	41,699	(8,340)	[2,002]	{1,001}	41,828	(8,366)	[2,008]	{1,004}
Ventura	101,502	101,576	101,576	101,576	101,714	(20,343)	[4,882]	{2,441}	101,852	(20,370)	[4,889]	{2,444}	101,990	(20,398)	[4,896]	{2,448}

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.