

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/30/20**

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 10/30/20 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.

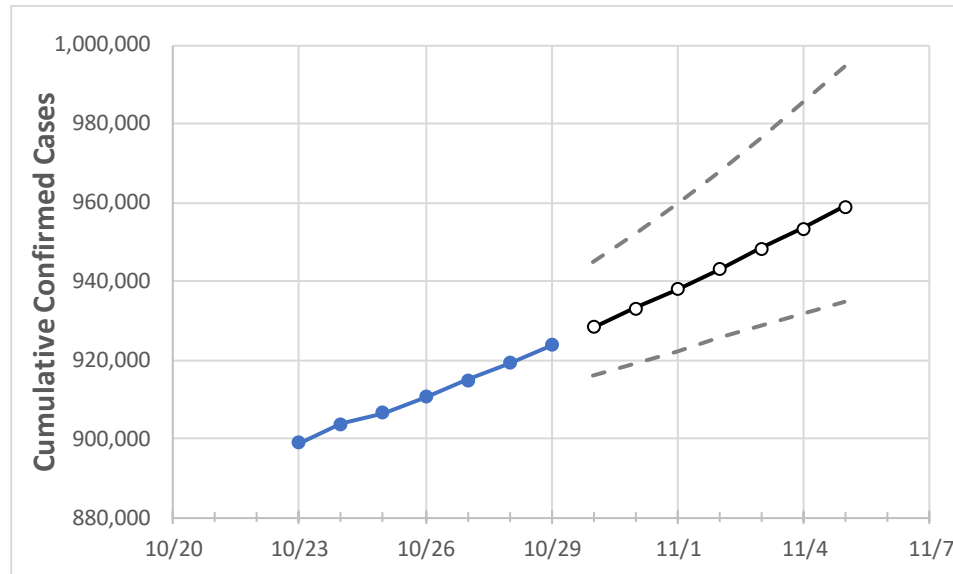
IEM's Modeling Lead

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:						
	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5
California	910,438	914,888	919,276	923,648	928,300	933,073	937,973	943,001	948,160	953,455	958,888

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 20%, and are often within 10%, of actual confirmed cases.

California Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5
Alameda	23,391	23,471	23,576	23,636	23,744	23,855	23,970	24,089	24,212	24,339	24,470
Contra Costa	18,694	18,763	18,817	18,877	18,954	19,032	19,112	19,192	19,274	19,357	19,442
Fresno	30,858	30,969	31,096	31,195	31,335	31,479	31,628	31,782	31,941	32,105	32,274
Kern	33,881	33,928	34,027	34,114	34,180	34,245	34,312	34,378	34,445	34,512	34,579
Los Angeles	300,614	302,077	303,369	305,070	306,280	307,518	308,786	310,085	311,413	312,773	314,165
Marin	7,089	7,096	7,099	7,107	7,113	7,119	7,124	7,130	7,135	7,140	7,144
Monterey	11,399	11,419	11,472	11,538	11,577	11,615	11,652	11,689	11,726	11,761	11,797
Orange	58,725	58,980	59,213	59,442	59,704	59,974	60,253	60,540	60,838	61,145	61,461
Placer	4,178	4,207	4,248	4,290	4,307	4,324	4,342	4,361	4,380	4,399	4,419
Riverside	66,732	66,993	67,299	67,552	67,831	68,120	68,418	68,726	69,045	69,375	69,716
Sacramento	25,445	25,601	25,750	25,882	26,037	26,197	26,363	26,535	26,712	26,896	27,087
San Bernardino	62,774	63,367	63,850	64,131	64,495	64,873	65,266	65,675	66,100	66,541	66,999
San Diego	54,941	55,210	55,540	55,898	56,254	56,616	56,986	57,363	57,748	58,139	58,539
San Francisco	12,152	12,189	12,241	12,277	12,313	12,349	12,385	12,421	12,458	12,495	12,533
San Joaquin	21,696	21,729	21,906	21,988	22,029	22,073	22,117	22,164	22,213	22,263	22,316
San Luis Obispo	4,163	4,174	4,191	4,240	4,259	4,278	4,297	4,316	4,335	4,354	4,374
San Mateo	11,149	11,198	11,232	11,278	11,325	11,372	11,420	11,468	11,518	11,568	11,619
Santa Barbara	9,814	9,827	9,874	9,886	9,911	9,937	9,963	9,989	10,016	10,042	10,069
Santa Clara	24,313	24,425	24,558	24,665	24,816	24,971	25,130	25,293	25,461	25,634	25,810
Santa Cruz	2,802	2,808	2,821	2,848	2,860	2,872	2,884	2,896	2,908	2,920	2,932
Solano	7,384	7,445	7,480	7,586	7,633	7,680	7,728	7,777	7,827	7,877	7,928
Sonoma	9,402	9,494	9,569	9,601	9,663	9,725	9,788	9,850	9,913	9,976	10,039
Ventura	14,300	14,330	14,347	14,409	14,453	14,497	14,542	14,585	14,629	14,673	14,717

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:											
	10/26	10/27	10/28	10/29	10/31				11/2				11/4			
Alameda	23,391	23,471	23,576	23,636	23,855	(4,771)	[1,145]	{573}	24,089	(4,818)	[1,156]	{578}	24,339	(4,868)	[1,168]	{584}
Contra Costa	18,694	18,763	18,817	18,877	19,032	(3,806)	[914]	{457}	19,192	(3,838)	[921]	{461}	19,357	(3,871)	[929]	{465}
Fresno	30,858	30,969	31,096	31,195	31,479	(6,296)	[1,511]	{755}	31,782	(6,356)	[1,526]	{763}	32,105	(6,421)	[1,541]	{771}
Kern	33,881	33,928	34,027	34,114	34,245	(6,849)	[1,644]	{822}	34,378	(6,876)	[1,650]	{825}	34,512	(6,902)	[1,657]	{828}
Los Angeles	300,614	302,077	303,369	305,070	307,518	(61,504)	[14,761]	{7,380}	310,085	(62,017)	[14,884]	{7,442}	312,773	(62,555)	[15,013]	{7,507}
Marin	7,089	7,096	7,099	7,107	7,119	(1,424)	[342]	{171}	7,130	(1,426)	[342]	{171}	7,140	(1,428)	[343]	{171}
Monterey	11,399	11,419	11,472	11,538	11,615	(2,323)	[558]	{279}	11,689	(2,338)	[561]	{281}	11,761	(2,352)	[565]	{282}
Orange	58,725	58,980	59,213	59,442	59,974	(11,995)	[2,879]	{1,439}	60,540	(12,108)	[2,906]	{1,453}	61,145	(12,229)	[2,935]	{1,467}
Placer	4,178	4,207	4,248	4,290	4,324	(865)	[208]	{104}	4,361	(872)	[209]	{105}	4,399	(880)	[211]	{106}
Riverside	66,732	66,993	67,299	67,552	68,120	(13,624)	[3,270]	{1,635}	68,726	(13,745)	[3,299]	{1,649}	69,375	(13,875)	[3,330]	{1,665}
Sacramento	25,445	25,601	25,750	25,882	26,197	(5,239)	[1,257]	{629}	26,535	(5,307)	[1,274]	{637}	26,896	(5,379)	[1,291]	{646}
San Bernardino	62,774	63,367	63,850	64,131	64,873	(12,975)	[3,114]	{1,557}	65,675	(13,135)	[3,152]	{1,576}	66,541	(13,308)	[3,194]	{1,597}
San Diego	54,941	55,210	55,540	55,898	56,616	(11,323)	[2,718]	{1,359}	57,363	(11,473)	[2,753]	{1,377}	58,139	(11,628)	[2,791]	{1,395}
San Francisco	12,152	12,189	12,241	12,277	12,349	(2,470)	[593]	{296}	12,421	(2,484)	[596]	{298}	12,495	(2,499)	[600]	{300}
San Joaquin	21,696	21,729	21,906	21,988	22,073	(4,415)	[1,059]	{530}	22,164	(4,433)	[1,064]	{532}	22,263	(4,453)	[1,069]	{534}
San Luis Obispo	4,163	4,174	4,191	4,240	4,278	(856)	[205]	{103}	4,316	(863)	[207]	{104}	4,354	(871)	[209]	{105}
San Mateo	11,149	11,198	11,232	11,278	11,372	(2,274)	[546]	{273}	11,468	(2,294)	[550]	{275}	11,568	(2,314)	[555]	{278}
Santa Barbara	9,814	9,827	9,874	9,886	9,937	(1,987)	[477]	{238}	9,989	(1,998)	[479]	{240}	10,042	(2,008)	[482]	{241}
Santa Clara	24,313	24,425	24,558	24,665	24,971	(4,994)	[1,199]	{599}	25,293	(5,059)	[1,214]	{607}	25,634	(5,127)	[1,230]	{615}
Santa Cruz	2,802	2,808	2,821	2,848	2,872	(574)	[138]	{69}	2,896	(579)	[139]	{69}	2,920	(584)	[140]	{70}
Solano	7,384	7,445	7,480	7,586	7,680	(1,536)	[369]	{184}	7,777	(1,555)	[373]	{187}	7,877	(1,575)	[378]	{189}
Sonoma	9,402	9,494	9,569	9,601	9,725	(1,945)	[467]	{233}	9,850	(1,970)	[473]	{236}	9,976	(1,995)	[479]	{239}
Ventura	14,300	14,330	14,347	14,409	14,497	(2,899)	[696]	{348}	14,585	(2,917)	[700]	{350}	14,673	(2,935)	[704]	{352}

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.