

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/29/20**

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 12/29/20 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.

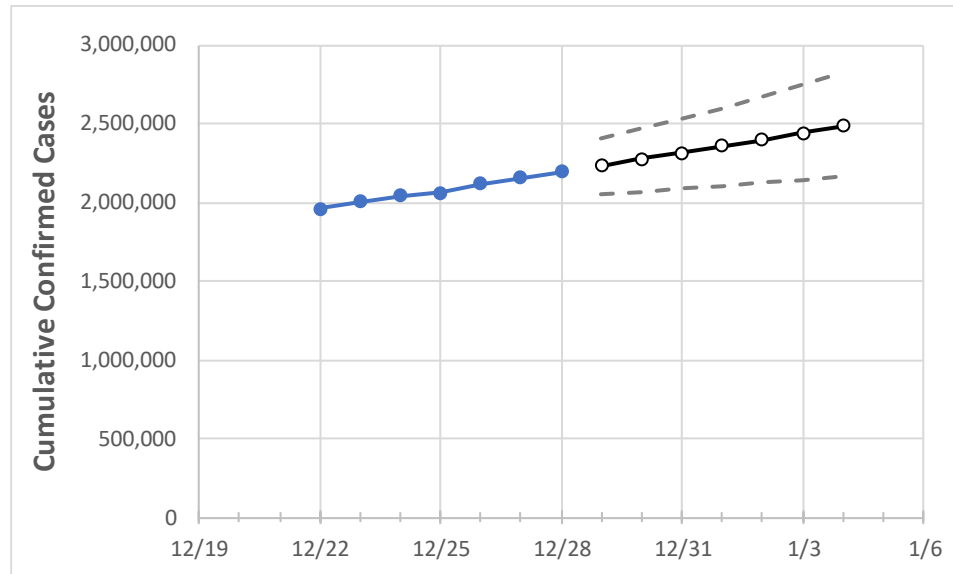
IEM's Modeling Lead

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:							
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	
California	2,060,797	2,120,610	2,156,389	2,192,684	2,233,122	2,274,173	2,316,202	2,356,717	2,398,792	2,440,891	2,483,992	

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:							
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	
Alameda	47,527	48,365	49,084	49,796	50,633	51,474	52,315	53,156	54,002	54,848	55,683	
Contra Costa	36,752	37,610	38,138	38,558	39,119	39,704	40,265	40,852	41,445	42,021	42,584	
Fresno	61,435	62,251	63,080	63,811	65,083	66,407	67,783	69,138	70,498	71,882	73,397	
Kern	62,439	63,044	63,557	64,810	65,771	66,768	67,736	68,721	69,667	70,627	71,598	
Lake	1,629	1,688	1,710	1,769	1,815	1,862	1,911	1,962	2,016	2,071	2,126	
Los Angeles	678,040	706,448	719,833	733,325	746,202	759,301	772,494	786,447	800,331	813,820	827,922	
Marin	9,377	9,449	9,505	9,569	9,654	9,741	9,831	9,919	10,009	10,101	10,192	
Monterey	25,131	25,788	26,010	26,322	26,828	27,320	27,830	28,334	28,856	29,366	29,873	
Orange	141,205	144,542	147,463	149,607	152,930	156,196	159,574	162,947	166,443	169,957	173,526	
Placer	12,457	12,660	12,816	13,055	13,266	13,470	13,677	13,875	14,074	14,263	14,459	
Riverside	162,435	166,690	169,360	174,477	178,350	182,274	186,068	189,946	193,912	197,937	202,015	
Sacramento	60,596	61,630	62,435	63,416	64,491	65,591	66,704	67,825	68,967	70,119	71,286	
San Bernardino	176,866	181,812	185,111	186,776	190,428	194,382	198,224	201,936	205,743	209,532	213,316	
San Diego	139,801	142,647	145,779	147,530	150,397	153,406	156,353	159,321	162,351	165,424	168,528	
San Francisco	21,830	22,130	22,319	22,514	22,760	23,009	23,254	23,495	23,738	23,981	24,230	
San Joaquin	41,324	42,089	42,887	43,529	44,411	45,324	46,235	47,155	48,114	49,004	49,910	
San Luis Obispo	9,504	9,749	9,945	10,154	10,358	10,566	10,772	10,988	11,208	11,433	11,657	
San Mateo	22,405	22,568	22,908	23,681	24,063	24,454	24,850	25,241	25,651	26,054	26,466	
Santa Barbara	15,657	15,936	16,159	16,364	16,598	16,840	17,099	17,369	17,625	17,898	18,175	
Santa Clara	61,742	63,302	64,974	66,270	67,649	69,065	70,470	71,939	73,432	74,922	76,472	
Santa Cruz	7,856	8,018	8,113	8,234	8,405	8,571	8,743	8,918	9,089	9,265	9,446	
Solano	17,396	17,462	17,528	18,518	18,868	19,248	19,632	20,044	20,460	20,892	21,345	
Sonoma	17,879	18,035	18,539	18,539	18,842	19,155	19,458	19,793	20,145	20,484	20,861	
Ventura	34,400	35,514	36,064	36,661	37,509	38,360	39,233	40,116	41,041	41,976	42,948	

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:									
	12/25	12/26	12/27	12/28	12/30		1/1		1/3					
Alameda	47,527	48,365	49,084	49,796	51,474	(10,295)	[2,471]	{1,235}	53,156	(10,631)	[2,551]	{1,276}	54,848	(10,970) [2,633] {1,316}
Contra Costa	36,752	37,610	38,138	38,558	39,704	(7,941)	[1,906]	{953}	40,852	(8,170)	[1,961]	{980}	42,021	(8,404) [2,017] {1,009}
Fresno	61,435	62,251	63,080	63,811	66,407	(13,281)	[3,188]	{1,594}	69,138	(13,828)	[3,319]	{1,659}	71,882	(14,376) [3,450] {1,725}
Kern	62,439	63,044	63,557	64,810	66,768	(13,354)	[3,205]	{1,602}	68,721	(13,744)	[3,299]	{1,649}	70,627	(14,125) [3,390] {1,695}
Lake	1,629	1,688	1,710	1,769	1,862	(372)	[89]	{45}	1,962	(392)	[94]	{47}	2,071	(414) [99] {50}
Los Angeles	678,040	706,448	719,833	733,325	759,301	(151,860)	[36,446]	{18,223}	786,447	(157,289)	[37,749]	{18,875}	813,820	(162,764) [39,063] {19,532}
Marin	9,377	9,449	9,505	9,569	9,741	(1,948)	[468]	{234}	9,919	(1,984)	[476]	{238}	10,101	(2,020) [485] {242}
Monterey	25,131	25,788	26,010	26,322	27,320	(5,464)	[1,311]	{656}	28,334	(5,667)	[1,360]	{680}	29,366	(5,873) [1,410] {705}
Orange	141,205	144,542	147,463	149,607	156,196	(31,239)	[7,497]	{3,749}	162,947	(32,589)	[7,821]	{3,911}	169,957	(33,991) [8,158] {4,079}
Placer	12,457	12,660	12,816	13,055	13,470	(2,694)	[647]	{323}	13,875	(2,775)	[666]	{333}	14,263	(2,853) [685] {342}
Riverside	162,435	166,690	169,360	174,477	182,274	(36,455)	[8,749]	{4,375}	189,946	(37,989)	[9,117]	{4,559}	197,937	(39,587) [9,501] {4,750}
Sacramento	60,596	61,630	62,435	63,416	65,591	(13,118)	[3,148]	{1,574}	67,825	(13,565)	[3,256]	{1,628}	70,119	(14,024) [3,366] {1,683}
San Bernardino	176,866	181,812	185,111	186,776	194,382	(38,876)	[9,330]	{4,665}	201,936	(40,387)	[9,693]	{4,846}	209,532	(41,906) [10,058] {5,029}
San Diego	139,801	142,647	145,779	147,530	153,406	(30,681)	[7,363]	{3,682}	159,321	(31,864)	[7,647]	{3,824}	165,424	(33,085) [7,940] {3,970}
San Francisco	21,830	22,130	22,319	22,514	23,009	(4,602)	[1,104]	{552}	23,495	(4,699)	[1,128]	{564}	23,981	(4,796) [1,151] {576}
San Joaquin	41,324	42,089	42,887	43,529	45,324	(9,065)	[2,176]	{1,088}	47,155	(9,431)	[2,263]	{1,132}	49,004	(9,801) [2,352] {1,176}
San Luis Obispo	9,504	9,749	9,945	10,154	10,566	(2,113)	[507]	{254}	10,988	(2,198)	[527]	{264}	11,433	(2,287) [549] {274}
San Mateo	22,405	22,568	22,908	23,681	24,454	(4,891)	[1,174]	{587}	25,241	(5,048)	[1,212]	{606}	26,054	(5,211) [1,251] {625}
Santa Barbara	15,657	15,936	16,159	16,364	16,840	(3,368)	[808]	{404}	17,369	(3,474)	[834]	{417}	17,898	(3,580) [859] {430}
Santa Clara	61,742	63,302	64,974	66,270	69,065	(13,813)	[3,315]	{1,658}	71,939	(14,388)	[3,453]	{1,727}	74,922	(14,984) [3,596] {1,798}
Santa Cruz	7,856	8,018	8,113	8,234	8,571	(1,714)	[411]	{206}	8,918	(1,784)	[428]	{214}	9,265	(1,853) [445] {222}
Solano	17,396	17,462	17,528	18,518	19,248	(3,850)	[924]	{462}	20,044	(4,009)	[962]	{481}	20,892	(4,178) [1,003] {501}
Sonoma	17,879	18,035	18,539	18,539	19,155	(3,831)	[919]	{460}	19,793	(3,959)	[950]	{475}	20,484	(4,097) [983] {492}
Ventura	34,400	35,514	36,064	36,661	38,360	(7,672)	[1,841]	{921}	40,116	(8,023)	[1,926]	{963}	41,976	(8,395) [2,015] {1,007}

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.