

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 11/16/20**

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 11/16/20 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.

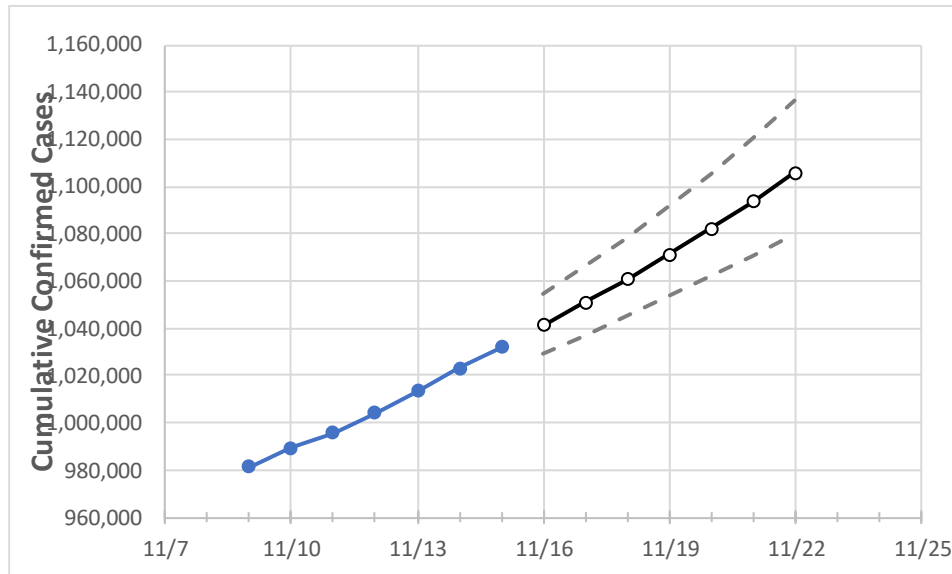
IEM's Modeling Lead

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:					
	11/12	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22
California	1,004,116	1,013,566	1,023,067	1,032,095	1,041,239	1,050,810	1,060,826	1,071,306	1,082,272	1,093,745	1,105,747

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:						
	11/12	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22
Alameda	25,400	25,599	25,760	25,872	26,021	26,175	26,333	26,495	26,663	26,836	27,013
Contra Costa	20,452	20,619	20,868	21,046	21,208	21,378	21,554	21,738	21,930	22,130	22,338
Fresno	33,287	33,459	33,693	33,969	34,162	34,362	34,569	34,784	35,006	35,237	35,475
Kern	35,818	36,069	36,227	36,470	36,673	36,888	37,114	37,352	37,604	37,869	38,149
Los Angeles	330,450	332,865	336,549	339,560	342,652	345,911	349,344	352,962	356,773	360,788	365,017
Marin	7,305	7,326	7,344	7,358	7,374	7,391	7,408	7,425	7,443	7,462	7,481
Monterey	12,534	12,606	12,701	12,854	12,946	13,041	13,140	13,244	13,351	13,462	13,578
Orange	63,460	64,058	64,586	65,225	65,669	66,132	66,613	67,114	67,636	68,180	68,745
Placer	5,056	5,134	5,175	5,215	5,286	5,360	5,440	5,524	5,613	5,708	5,809
Riverside	73,541	74,180	74,545	74,910	75,444	76,001	76,582	77,187	77,818	78,476	79,162
Sacramento	29,014	29,510	29,837	30,298	30,676	31,077	31,501	31,950	32,425	32,928	33,460
San Bernardino	71,847	73,001	73,915	74,166	74,870	75,607	76,378	77,185	78,030	78,914	79,839
San Diego	62,334	62,945	63,681	64,768	65,129	65,495	65,865	66,239	66,618	67,001	67,388
San Francisco	13,308	13,404	13,516	13,665	13,783	13,908	14,040	14,178	14,325	14,478	14,641
San Joaquin	23,001	23,224	23,517	23,517	23,585	23,657	23,732	23,811	23,895	23,982	24,073
San Luis Obispo	4,909	4,972	5,038	5,073	5,139	5,209	5,285	5,366	5,454	5,548	5,650
San Mateo	12,230	12,332	12,465	12,465	12,567	12,674	12,786	12,903	13,026	13,155	13,290
Santa Barbara	10,278	10,339	10,415	10,482	10,524	10,567	10,612	10,658	10,706	10,756	10,808
Santa Clara	27,299	27,648	27,977	28,307	28,574	28,851	29,138	29,436	29,746	30,068	30,401
Santa Cruz	3,247	3,329	3,356	3,402	3,432	3,464	3,496	3,530	3,566	3,603	3,642
Solano	8,596	8,729	8,729	8,729	8,818	8,911	9,008	9,109	9,214	9,323	9,436
Sonoma	10,679	10,713	10,747	10,845	10,916	10,987	11,058	11,130	11,202	11,275	11,348
Ventura	15,801	16,013	16,172	16,297	16,440	16,590	16,748	16,914	17,089	17,274	17,467

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:											
	11/12	11/13	11/14	11/15	11/17				11/19				11/21			
Alameda	25,400	25,599	25,760	25,872	26,175	(5,235)	[1,256]	{628}	26,495	(5,299)	[1,272]	{636}	26,836	(5,367)	[1,288]	{644}
Contra Costa	20,452	20,619	20,868	21,046	21,378	(4,276)	[1,026]	{513}	21,738	(4,348)	[1,043]	{522}	22,130	(4,426)	[1,062]	{531}
Fresno	33,287	33,459	33,693	33,969	34,362	(6,872)	[1,649]	{825}	34,784	(6,957)	[1,670]	{835}	35,237	(7,047)	[1,691]	{846}
Kern	35,818	36,069	36,227	36,470	36,888	(7,378)	[1,771]	{885}	37,352	(7,470)	[1,793]	{896}	37,869	(7,574)	[1,818]	{909}
Los Angeles	330,450	332,865	336,549	339,560	345,911	(69,182)	[16,604]	{8,302}	352,962	(70,592)	[16,942]	{8,471}	360,788	(72,158)	[17,318]	{8,659}
Marin	7,305	7,326	7,344	7,358	7,391	(1,478)	[355]	{177}	7,425	(1,485)	[356]	{178}	7,462	(1,492)	[358]	{179}
Monterey	12,534	12,606	12,701	12,854	13,041	(2,608)	[626]	{313}	13,244	(2,649)	[636]	{318}	13,462	(2,692)	[646]	{323}
Orange	63,460	64,058	64,586	65,225	66,132	(13,226)	[3,174]	{1,587}	67,114	(13,423)	[3,221]	{1,611}	68,180	(13,636)	[3,273]	{1,636}
Placer	5,056	5,134	5,175	5,215	5,360	(1,072)	[257]	{129}	5,524	(1,105)	[265]	{133}	5,708	(1,142)	[274]	{137}
Riverside	73,541	74,180	74,545	74,910	76,001	(15,200)	[3,648]	{1,824}	77,187	(15,437)	[3,705]	{1,852}	78,476	(15,695)	[3,767]	{1,883}
Sacramento	29,014	29,510	29,837	30,298	31,077	(6,215)	[1,492]	{746}	31,950	(6,390)	[1,534]	{767}	32,928	(6,586)	[1,581]	{790}
San Bernardino	71,847	73,001	73,915	74,166	75,607	(15,121)	[3,629]	{1,815}	77,185	(15,437)	[3,705]	{1,852}	78,914	(15,783)	[3,788]	{1,894}
San Diego	62,334	62,945	63,681	64,768	65,495	(13,099)	[3,144]	{1,572}	66,239	(13,248)	[3,179]	{1,590}	67,001	(13,400)	[3,216]	{1,608}
San Francisco	13,308	13,404	13,516	13,665	13,908	(2,782)	[668]	{334}	14,178	(2,836)	[681]	{340}	14,478	(2,896)	[695]	{347}
San Joaquin	23,001	23,224	23,517	23,517	23,657	(4,731)	[1,136]	{568}	23,811	(4,762)	[1,143]	{571}	23,982	(4,796)	[1,151]	{576}
San Luis Obispo	4,909	4,972	5,038	5,073	5,209	(1,042)	[250]	{125}	5,366	(1,073)	[258]	{129}	5,548	(1,110)	[266]	{133}
San Mateo	12,230	12,332	12,465	12,465	12,674	(2,535)	[608]	{304}	12,903	(2,581)	[619]	{310}	13,155	(2,631)	[631]	{316}
Santa Barbara	10,278	10,339	10,415	10,482	10,567	(2,113)	[507]	{254}	10,658	(2,132)	[512]	{256}	10,756	(2,151)	[516]	{258}
Santa Clara	27,299	27,648	27,977	28,307	28,851	(5,770)	[1,385]	{692}	29,436	(5,887)	[1,413]	{706}	30,068	(6,014)	[1,443]	{722}
Santa Cruz	3,247	3,329	3,356	3,402	3,464	(693)	[166]	{83}	3,530	(706)	[169]	{85}	3,603	(721)	[173]	{86}
Solano	8,596	8,729	8,729	8,729	8,911	(1,782)	[428]	{214}	9,109	(1,822)	[437]	{219}	9,323	(1,865)	[447]	{224}
Sonoma	10,679	10,713	10,747	10,845	10,987	(2,197)	[527]	{264}	11,130	(2,226)	[534]	{267}	11,275	(2,255)	[541]	{271}
Ventura	15,801	16,013	16,172	16,297	16,590	(3,318)	[796]	{398}	16,914	(3,383)	[812]	{406}	17,274	(3,455)	[829]	{415}

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.