

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

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 10/20/20 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.

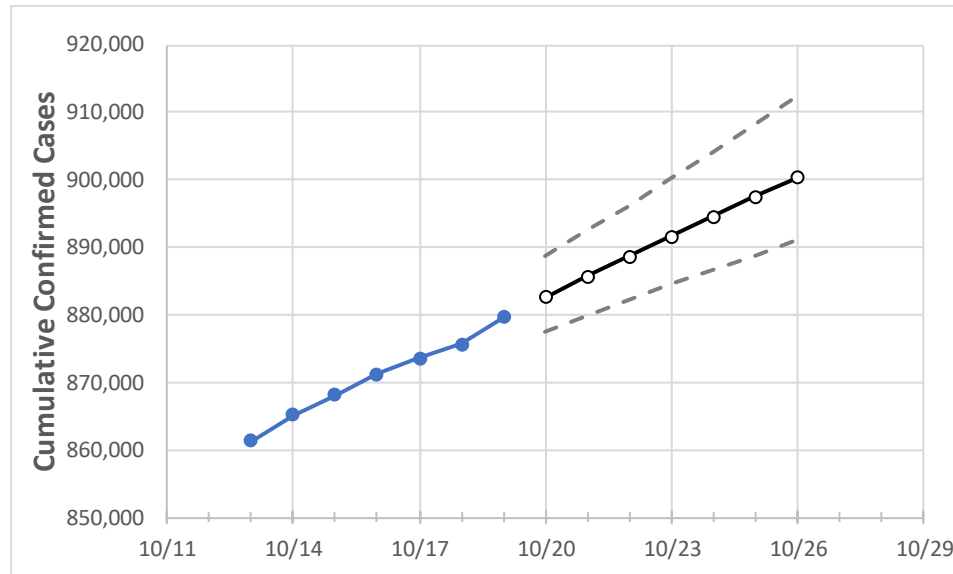
IEM's Modeling Lead

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:						
	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26
California	871,253	873,614	875,692	879,645	882,645	885,632	888,605	891,566	894,513	897,448	900,369

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:						
	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26
Alameda	22,408	22,459	22,636	22,738	22,793	22,848	22,903	22,959	23,015	23,071	23,128
Contra Costa	17,945	17,997	18,054	18,157	18,211	18,265	18,317	18,369	18,421	18,471	18,521
Fresno	29,727	29,796	29,911	30,051	30,116	30,181	30,246	30,310	30,374	30,437	30,500
Kern	33,225	33,286	33,373	33,448	33,523	33,600	33,678	33,757	33,838	33,920	34,003
Los Angeles	287,222	288,136	288,451	289,366	290,214	291,055	291,891	292,720	293,544	294,362	295,173
Marin	6,966	6,982	7,001	7,019	7,034	7,050	7,066	7,082	7,099	7,115	7,132
Monterey	10,887	10,943	11,022	11,091	11,144	11,197	11,252	11,307	11,363	11,420	11,478
Orange	56,587	56,672	56,868	57,071	57,236	57,402	57,569	57,737	57,905	58,075	58,245
Placer	3,880	3,889	3,898	3,978	3,993	4,008	4,023	4,038	4,054	4,070	4,086
Riverside	63,284	63,548	63,811	64,075	64,206	64,338	64,471	64,604	64,739	64,875	65,011
Sacramento	24,102	24,192	24,304	24,425	24,497	24,569	24,639	24,708	24,777	24,844	24,911
San Bernardino	59,463	59,602	59,696	59,779	59,960	60,139	60,317	60,493	60,668	60,841	61,012
San Diego	51,781	51,982	52,355	52,735	53,029	53,327	53,627	53,931	54,238	54,549	54,862
San Francisco	11,808	11,840	11,877	11,901	11,919	11,937	11,954	11,971	11,987	12,002	12,018
San Joaquin	21,138	21,187	21,187	21,187	21,222	21,257	21,292	21,327	21,361	21,396	21,431
San Luis Obispo	3,969	3,985	3,997	4,009	4,026	4,044	4,062	4,080	4,098	4,117	4,135
San Mateo	10,687	10,743	10,777	10,810	10,841	10,871	10,900	10,929	10,957	10,985	11,013
Santa Barbara	9,540	9,560	9,588	9,608	9,628	9,648	9,668	9,688	9,707	9,726	9,745
Santa Clara	22,974	23,052	23,224	23,355	23,460	23,566	23,673	23,781	23,891	24,002	24,114
Santa Cruz	2,670	2,682	2,696	2,706	2,720	2,733	2,747	2,761	2,776	2,790	2,805
Solano	7,009	7,045	7,081	7,117	7,159	7,202	7,247	7,292	7,338	7,385	7,433
Sonoma	8,717	8,810	8,872	8,934	8,998	9,062	9,126	9,190	9,254	9,317	9,381
Ventura	13,750	13,805	13,845	13,901	13,944	13,987	14,030	14,073	14,116	14,159	14,202

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:											
	10/16	10/17	10/18	10/19	10/21				10/23				10/25			
Alameda	22,408	22,459	22,636	22,738	22,848	(4,570)	[1,097]	{548}	22,959	(4,592)	[1,102]	{551}	23,071	(4,614)	[1,107]	{554}
Contra Costa	17,945	17,997	18,054	18,157	18,265	(3,653)	[877]	{438}	18,369	(3,674)	[882]	{441}	18,471	(3,694)	[887]	{443}
Fresno	29,727	29,796	29,911	30,051	30,181	(6,036)	[1,449]	{724}	30,310	(6,062)	[1,455]	{727}	30,437	(6,087)	[1,461]	{730}
Kern	33,225	33,286	33,373	33,448	33,600	(6,720)	[1,613]	{806}	33,757	(6,751)	[1,620]	{810}	33,920	(6,784)	[1,628]	{814}
Los Angeles	287,222	288,136	288,451	289,366	291,055	(58,211)	[13,971]	{6,985}	292,720	(58,544)	[14,051]	{7,025}	294,362	(58,872)	[14,129]	{7,065}
Marin	6,966	6,982	7,001	7,019	7,050	(1,410)	[338]	{169}	7,082	(1,416)	[340]	{170}	7,115	(1,423)	[342]	{171}
Monterey	10,887	10,943	11,022	11,091	11,197	(2,239)	[537]	{269}	11,307	(2,261)	[543]	{271}	11,420	(2,284)	[548]	{274}
Orange	56,587	56,672	56,868	57,071	57,402	(11,480)	[2,755]	{1,378}	57,737	(11,547)	[2,771]	{1,386}	58,075	(11,615)	[2,788]	{1,394}
Placer	3,880	3,889	3,898	3,978	4,008	(802)	[192]	{96}	4,038	(808)	[194]	{97}	4,070	(814)	[195]	{98}
Riverside	63,284	63,548	63,811	64,075	64,338	(12,868)	[3,088]	{1,544}	64,604	(12,921)	[3,101]	{1,551}	64,875	(12,975)	[3,114]	{1,557}
Sacramento	24,102	24,192	24,304	24,425	24,569	(4,914)	[1,179]	{590}	24,708	(4,942)	[1,186]	{593}	24,844	(4,969)	[1,193]	{596}
San Bernardino	59,463	59,602	59,696	59,779	60,139	(12,028)	[2,887]	{1,443}	60,493	(12,099)	[2,904]	{1,452}	60,841	(12,168)	[2,920]	{1,460}
San Diego	51,781	51,982	52,355	52,735	53,327	(10,665)	[2,560]	{1,280}	53,931	(10,786)	[2,589]	{1,294}	54,549	(10,910)	[2,618]	{1,309}
San Francisco	11,808	11,840	11,877	11,901	11,937	(2,387)	[573]	{286}	11,971	(2,394)	[575]	{287}	12,002	(2,400)	[576]	{288}
San Joaquin	21,138	21,187	21,187	21,187	21,257	(4,251)	[1,020]	{510}	21,327	(4,265)	[1,024]	{512}	21,396	(4,279)	[1,027]	{514}
San Luis Obispo	3,969	3,985	3,997	4,009	4,044	(809)	[194]	{97}	4,080	(816)	[196]	{98}	4,117	(823)	[198]	{99}
San Mateo	10,687	10,743	10,777	10,810	10,871	(2,174)	[522]	{261}	10,929	(2,186)	[525]	{262}	10,985	(2,197)	[527]	{264}
Santa Barbara	9,540	9,560	9,588	9,608	9,648	(1,930)	[463]	{232}	9,688	(1,938)	[465]	{233}	9,726	(1,945)	[467]	{233}
Santa Clara	22,974	23,052	23,224	23,355	23,566	(4,713)	[1,131]	{566}	23,781	(4,756)	[1,142]	{571}	24,002	(4,800)	[1,152]	{576}
Santa Cruz	2,670	2,682	2,696	2,706	2,733	(547)	[131]	{66}	2,761	(552)	[133]	{66}	2,790	(558)	[134]	{67}
Solano	7,009	7,045	7,081	7,117	7,202	(1,440)	[346]	{173}	7,292	(1,458)	[350]	{175}	7,385	(1,477)	[354]	{177}
Sonoma	8,717	8,810	8,872	8,934	9,062	(1,812)	[435]	{217}	9,190	(1,838)	[441]	{221}	9,317	(1,863)	[447]	{224}
Ventura	13,750	13,805	13,845	13,901	13,987	(2,797)	[671]	{336}	14,073	(2,815)	[675]	{338}	14,159	(2,832)	[680]	{340}

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.