

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 7/7/21

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 7/7/21 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.

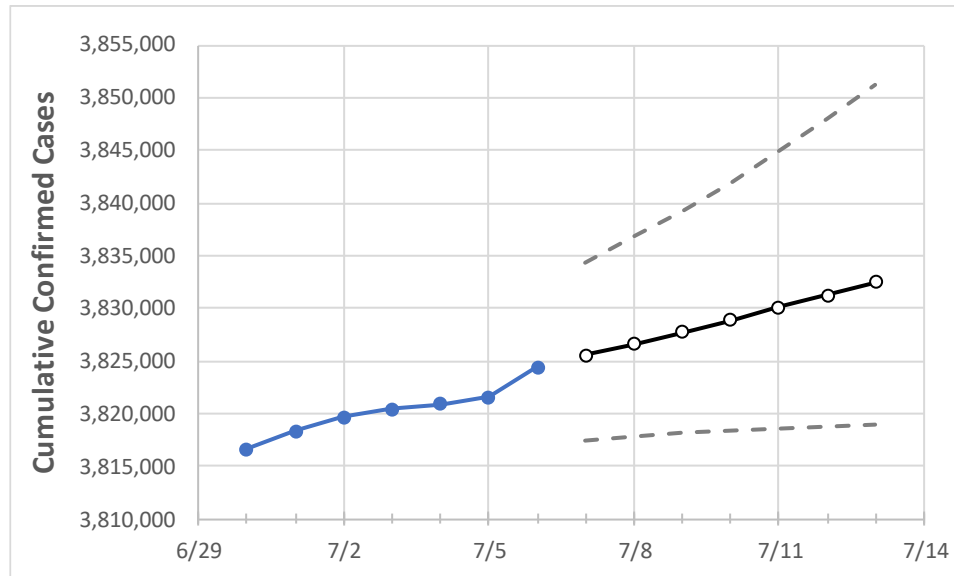
IEM's Modeling Lead

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:							
	7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	
California	3,820,442	3,820,921	3,821,572	3,824,369	3,825,530	3,826,624	3,827,728	3,828,855	3,830,074	3,831,267	3,832,427	

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:						
	7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13
Alameda	90,418	90,375	90,429	90,483	90,553	90,623	90,698	90,777	90,856	90,932	91,017
Contra Costa	71,478	71,548	71,616	71,648	71,720	71,794	71,871	71,950	72,032	72,114	72,195
Fresno	102,532	102,552	102,572	102,592	102,609	102,627	102,643	102,660	102,677	102,693	102,709
Kern	111,111	111,111	111,111	111,111	111,121	111,132	111,141	111,150	111,158	111,166	111,173
Lake	3,629	3,634	3,640	3,645	3,655	3,666	3,677	3,690	3,704	3,719	3,735
Los Angeles	1,251,848	1,252,303	1,252,739	1,253,106	1,253,655	1,254,252	1,254,880	1,255,543	1,256,249	1,256,988	1,257,764
Marin	14,269	14,274	14,279	14,282	14,289	14,296	14,304	14,312	14,320	14,329	14,338
Monterey	43,925	43,925	43,925	43,925	43,931	43,936	43,942	43,947	43,953	43,958	43,964
Orange	273,837	273,935	274,034	274,132	274,246	274,366	274,493	274,628	274,771	274,921	275,081
Placer	23,851	23,857	23,862	23,867	23,882	23,896	23,909	23,923	23,936	23,950	23,963
Riverside	301,820	301,820	301,820	301,820	301,841	301,863	301,885	301,905	301,924	301,941	301,959
Sacramento	108,938	109,048	109,158	109,268	109,403	109,547	109,697	109,856	110,022	110,192	110,371
San Bernardino	299,972	299,997	300,021	300,045	300,092	300,138	300,186	300,233	300,280	300,328	300,379
San Diego	282,728	282,763	282,799	282,834	282,886	282,936	282,986	283,034	283,080	283,126	283,172
San Francisco	37,126	37,144	37,166	37,237	37,272	37,309	37,350	37,393	37,439	37,488	37,541
San Joaquin	75,033	75,066	75,100	75,133	75,156	75,179	75,202	75,224	75,247	75,270	75,293
San Luis Obispo	21,503	21,508	21,513	21,518	21,523	21,529	21,534	21,539	21,545	21,550	21,556
San Mateo	42,737	42,784	42,830	42,876	42,931	42,988	43,051	43,116	43,183	43,259	43,335
Santa Barbara	34,668	34,676	34,684	34,692	34,702	34,713	34,724	34,735	34,746	34,758	34,771
Santa Clara	119,498	119,555	119,612	119,623	119,671	119,717	119,766	119,818	119,871	119,924	119,977
Santa Cruz	16,296	16,299	16,303	16,306	16,310	16,313	16,317	16,320	16,324	16,327	16,330
Solano	34,044	34,044	34,044	34,044	34,059	34,075	34,090	34,105	34,119	34,133	34,148
Sonoma	31,160	31,160	31,160	31,160	31,192	31,222	31,254	31,284	31,314	31,344	31,378
Ventura	81,947	81,947	81,947	81,947	81,961	81,975	81,988	82,000	82,013	82,025	82,038

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:											
	7/3	7/4	7/5	7/6	7/8				7/10				7/12			
Alameda	90,418	90,375	90,429	90,483	90,623	(18,125)	[4,350]	{2,175}	90,777	(18,155)	[4,357]	{2,179}	90,932	(18,186)	[4,365]	{2,182}
Contra Costa	71,478	71,548	71,616	71,648	71,794	(14,359)	[3,446]	{1,723}	71,950	(14,390)	[3,454]	{1,727}	72,114	(14,423)	[3,461]	{1,731}
Fresno	102,532	102,552	102,572	102,592	102,627	(20,525)	[4,926]	{2,463}	102,660	(20,532)	[4,928]	{2,464}	102,693	(20,539)	[4,929]	{2,465}
Kern	111,111	111,111	111,111	111,111	111,132	(22,226)	[5,334]	{2,667}	111,150	(22,230)	[5,335]	{2,668}	111,166	(22,233)	[5,336]	{2,668}
Lake	3,629	3,634	3,640	3,645	3,666	(733)	[176]	{88}	3,690	(738)	[177]	{89}	3,719	(744)	[179]	{89}
Los Angeles	1,251,848	1,252,303	1,252,739	1,253,106	1,254,252	(250,850)	[60,204]	{30,102}	1,255,543	(251,109)	[60,266]	{30,133}	1,256,988	(251,398)	[60,335]	{30,168}
Marin	14,269	14,274	14,279	14,282	14,296	(2,859)	[686]	{343}	14,312	(2,862)	[687]	{343}	14,329	(2,866)	[688]	{344}
Monterey	43,925	43,925	43,925	43,925	43,936	(8,787)	[2,109]	{1,054}	43,947	(8,789)	[2,109]	{1,055}	43,958	(8,792)	[2,110]	{1,055}
Orange	273,837	273,935	274,034	274,132	274,366	(54,873)	[13,170]	{6,585}	274,628	(54,926)	[13,182]	{6,591}	274,921	(54,984)	[13,196]	{6,598}
Placer	23,851	23,857	23,862	23,867	23,896	(4,779)	[1,147]	{574}	23,923	(4,785)	[1,148]	{574}	23,950	(4,790)	[1,150]	{575}
Riverside	301,820	301,820	301,820	301,820	301,863	(60,373)	[14,489]	{7,245}	301,905	(60,381)	[14,491]	{7,246}	301,941	(60,388)	[14,493]	{7,247}
Sacramento	108,938	109,048	109,158	109,268	109,547	(21,909)	[5,258]	{2,629}	109,856	(21,971)	[5,273]	{2,637}	110,192	(22,038)	[5,289]	{2,645}
San Bernardino	299,972	299,997	300,021	300,045	300,138	(60,028)	[14,407]	{7,203}	300,233	(60,047)	[14,411]	{7,206}	300,328	(60,066)	[14,416]	{7,208}
San Diego	282,728	282,763	282,799	282,834	282,936	(56,587)	[13,581]	{6,790}	283,034	(56,607)	[13,586]	{6,793}	283,126	(56,625)	[13,590]	{6,795}
San Francisco	37,126	37,144	37,166	37,237	37,309	(7,462)	[1,791]	{895}	37,393	(7,479)	[1,795]	{897}	37,488	(7,498)	[1,799]	{900}
San Joaquin	75,033	75,066	75,100	75,133	75,179	(15,036)	[3,609]	{1,804}	75,224	(15,045)	[3,611]	{1,805}	75,270	(15,054)	[3,613]	{1,806}
San Luis Obispo	21,503	21,508	21,513	21,518	21,529	(4,306)	[1,033]	{517}	21,539	(4,308)	[1,034]	{517}	21,550	(4,310)	[1,034]	{517}
San Mateo	42,737	42,784	42,830	42,876	42,988	(8,598)	[2,063]	{1,032}	43,116	(8,623)	[2,070]	{1,035}	43,259	(8,652)	[2,076]	{1,038}
Santa Barbara	34,668	34,676	34,684	34,692	34,713	(6,943)	[1,666]	{833}	34,735	(6,947)	[1,667]	{834}	34,758	(6,952)	[1,668]	{834}
Santa Clara	119,498	119,555	119,612	119,623	119,717	(23,943)	[5,746]	{2,873}	119,818	(23,964)	[5,751]	{2,876}	119,924	(23,985)	[5,756]	{2,878}
Santa Cruz	16,296	16,299	16,303	16,306	16,313	(3,263)	[783]	{392}	16,320	(3,264)	[783]	{392}	16,327	(3,265)	[784]	{392}
Solano	34,044	34,044	34,044	34,044	34,075	(6,815)	[1,636]	{818}	34,105	(6,821)	[1,637]	{819}	34,133	(6,827)	[1,638]	{819}
Sonoma	31,160	31,160	31,160	31,160	31,222	(6,244)	[1,499]	{749}	31,284	(6,257)	[1,502]	{751}	31,344	(6,269)	[1,505]	{752}
Ventura	81,947	81,947	81,947	81,947	81,975	(16,395)	[3,935]	{1,967}	82,000	(16,400)	[3,936]	{1,968}	82,025	(16,405)	[3,937]	{1,969}

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.