

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

Date: 5/25/21

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 5/25/21 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.

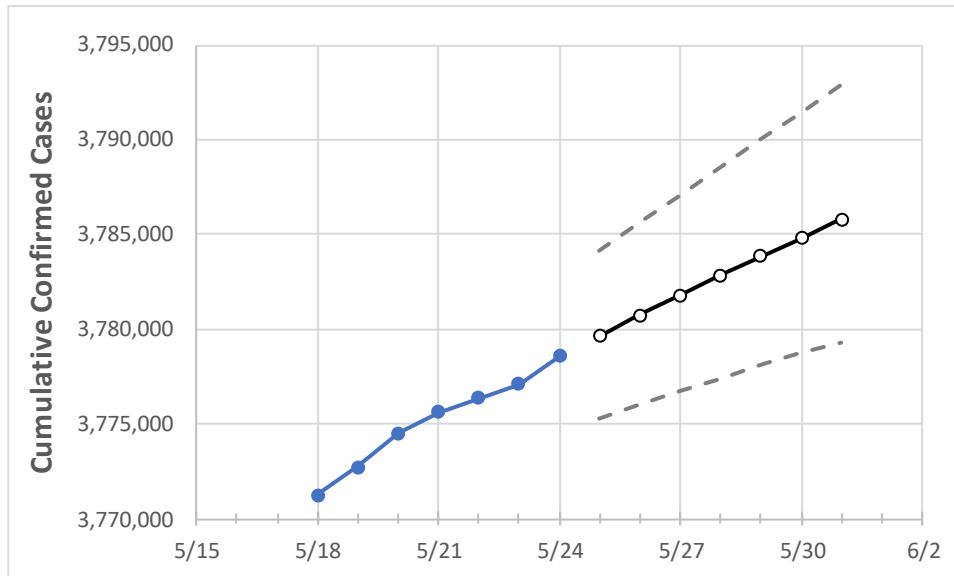
IEM's Modeling Lead

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:						
	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31

California 3,775,619 3,776,346 3,777,077 3,778,555 3,779,651 3,780,742 3,781,784 3,782,832 3,783,831 3,784,815 3,785,799

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:							
	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	
Alameda	88,483	88,502	88,545	88,620	88,676	88,730	88,785	88,840	88,894	88,949	89,004	
Contra Costa	69,245	69,288	69,357	69,392	69,440	69,487	69,532	69,578	69,622	69,666	69,709	
Fresno	102,135	102,189	102,238	102,270	102,307	102,345	102,383	102,421	102,458	102,495	102,532	
Kern	109,566	109,630	109,654	109,676	109,718	109,758	109,798	109,836	109,875	109,912	109,950	
Lake	3,500	3,501	3,502	3,504	3,506	3,508	3,510	3,513	3,515	3,517	3,519	
Los Angeles	1,238,382	1,238,607	1,238,781	1,238,932	1,239,117	1,239,299	1,239,474	1,239,651	1,239,820	1,239,989	1,240,149	
Marin	14,100	14,106	14,110	14,114	14,118	14,122	14,126	14,130	14,134	14,137	14,140	
Monterey	43,662	43,673	43,684	43,695	43,703	43,711	43,717	43,724	43,731	43,738	43,745	
Orange	271,537	271,589	271,646	271,673	271,724	271,773	271,822	271,870	271,917	271,962	272,008	
Placer	22,871	22,887	22,902	22,918	22,938	22,958	22,977	22,996	23,015	23,033	23,051	
Riverside	300,246	300,271	300,296	300,321	300,384	300,447	300,512	300,573	300,635	300,694	300,754	
Sacramento	105,604	105,684	105,765	105,845	105,931	106,013	106,097	106,182	106,264	106,348	106,430	
San Bernardino	297,479	297,539	297,566	297,615	297,675	297,733	297,791	297,848	297,904	297,959	298,012	
San Diego	279,553	279,613	279,689	279,714	279,813	279,909	280,003	280,094	280,183	280,271	280,354	
San Francisco	36,860	36,879	36,906	36,927	36,943	36,958	36,973	36,988	37,003	37,018	37,032	
San Joaquin	73,544	73,568	73,593	73,617	73,641	73,666	73,689	73,712	73,734	73,756	73,776	
San Luis Obispo	21,256	21,258	21,261	21,263	21,268	21,273	21,278	21,282	21,287	21,291	21,295	
San Mateo	42,152	42,163	42,218	42,248	42,273	42,297	42,321	42,345	42,369	42,392	42,413	
Santa Barbara	34,431	34,439	34,443	34,446	34,453	34,459	34,465	34,471	34,476	34,481	34,486	
Santa Clara	119,222	119,247	119,292	119,333	119,362	119,389	119,416	119,442	119,466	119,491	119,513	
Santa Cruz	16,159	16,164	16,168	16,173	16,176	16,179	16,182	16,184	16,186	16,189	16,190	
Solano	33,122	33,142	33,163	33,183	33,201	33,219	33,237	33,254	33,269	33,285	33,301	
Sonoma	30,150	30,168	30,169	30,170	30,180	30,190	30,200	30,210	30,219	30,229	30,238	
Ventura	81,204	81,222	81,239	81,257	81,279	81,300	81,322	81,343	81,363	81,383	81,403	

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:											
	5/21	5/22	5/23	5/24	5/26			5/28			5/30					
Alameda	88,483	88,502	88,545	88,620	88,730	(17,746)	[4,259]	{2,130}	88,840	(17,768)	[4,264]	{2,132}	88,949	(17,790)	[4,270]	{2,135}
Contra Costa	69,245	69,288	69,357	69,392	69,487	(13,897)	[3,335]	{1,668}	69,578	(13,916)	[3,340]	{1,670}	69,666	(13,933)	[3,344]	{1,672}
Fresno	102,135	102,189	102,238	102,270	102,345	(20,469)	[4,913]	{2,456}	102,421	(20,484)	[4,916]	{2,458}	102,495	(20,499)	[4,920]	{2,460}
Kern	109,566	109,630	109,654	109,676	109,758	(21,952)	[5,268]	{2,634}	109,836	(21,967)	[5,272]	{2,636}	109,912	(21,982)	[5,276]	{2,638}
Lake	3,500	3,501	3,502	3,504	3,508	(702)	[168]	{84}	3,513	(703)	[169]	{84}	3,517	(703)	[169]	{84}
Los Angeles	1,238,382	1,238,607	1,238,781	1,238,932	1,239,299	(247,860)	[59,486]	{29,743}	1,239,651	(247,930)	[59,503]	{29,752}	1,239,989	(247,998)	[59,519]	{29,760}
Marin	14,100	14,106	14,110	14,114	14,122	(2,824)	[678]	{339}	14,130	(2,826)	[678]	{339}	14,137	(2,827)	[679]	{339}
Monterey	43,662	43,673	43,684	43,695	43,711	(8,742)	[2,098]	{1,049}	43,724	(8,745)	[2,099]	{1,049}	43,738	(8,748)	[2,099]	{1,050}
Orange	271,537	271,589	271,646	271,673	271,773	(54,355)	[13,045]	{6,523}	271,870	(54,374)	[13,050]	{6,525}	271,962	(54,392)	[13,054]	{6,527}
Placer	22,871	22,887	22,902	22,918	22,958	(4,592)	[1,102]	{551}	22,996	(4,599)	[1,104]	{552}	23,033	(4,607)	[1,106]	{553}
Riverside	300,246	300,271	300,296	300,321	300,447	(60,089)	[14,421]	{7,211}	300,573	(60,115)	[14,428]	{7,214}	300,694	(60,139)	[14,433]	{7,217}
Sacramento	105,604	105,684	105,765	105,845	106,013	(21,203)	[5,089]	{2,544}	106,182	(21,236)	[5,097]	{2,548}	106,348	(21,270)	[5,105]	{2,552}
San Bernardino	297,479	297,539	297,566	297,615	297,733	(59,547)	[14,291]	{7,146}	297,848	(59,570)	[14,297]	{7,148}	297,959	(59,592)	[14,302]	{7,151}
San Diego	279,553	279,613	279,689	279,714	279,909	(55,982)	[13,436]	{6,718}	280,094	(56,019)	[13,445]	{6,722}	280,271	(56,054)	[13,453]	{6,727}
San Francisco	36,860	36,879	36,906	36,927	36,958	(7,392)	[1,774]	{887}	36,988	(7,398)	[1,775]	{888}	37,018	(7,404)	[1,777]	{888}
San Joaquin	73,544	73,568	73,593	73,617	73,666	(14,733)	[3,536]	{1,768}	73,712	(14,742)	[3,538]	{1,769}	73,756	(14,751)	[3,540]	{1,770}
San Luis Obispo	21,256	21,258	21,261	21,263	21,273	(4,255)	[1,021]	{511}	21,282	(4,256)	[1,022]	{511}	21,291	(4,258)	[1,022]	{511}
San Mateo	42,152	42,163	42,218	42,248	42,297	(8,459)	[2,030]	{1,015}	42,345	(8,469)	[2,033]	{1,016}	42,392	(8,478)	[2,035]	{1,017}
Santa Barbara	34,431	34,439	34,443	34,446	34,459	(6,892)	[1,654]	{827}	34,471	(6,894)	[1,655]	{827}	34,481	(6,896)	[1,655]	{828}
Santa Clara	119,222	119,247	119,292	119,333	119,389	(23,878)	[5,731]	{2,865}	119,442	(23,888)	[5,733]	{2,867}	119,491	(23,898)	[5,736]	{2,868}
Santa Cruz	16,159	16,164	16,168	16,173	16,179	(3,236)	[777]	{388}	16,184	(3,237)	[777]	{388}	16,189	(3,238)	[777]	{389}
Solano	33,122	33,142	33,163	33,183	33,219	(6,644)	[1,595]	{797}	33,254	(6,651)	[1,596]	{798}	33,285	(6,657)	[1,598]	{799}
Sonoma	30,150	30,168	30,169	30,170	30,190	(6,038)	[1,449]	{725}	30,210	(6,042)	[1,450]	{725}	30,229	(6,046)	[1,451]	{725}
Ventura	81,204	81,222	81,239	81,257	81,300	(16,260)	[3,902]	{1,951}	81,343	(16,269)	[3,904]	{1,952}	81,383	(16,277)	[3,906]	{1,953}

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.