

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 7/23/21**

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 7/23/21 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.

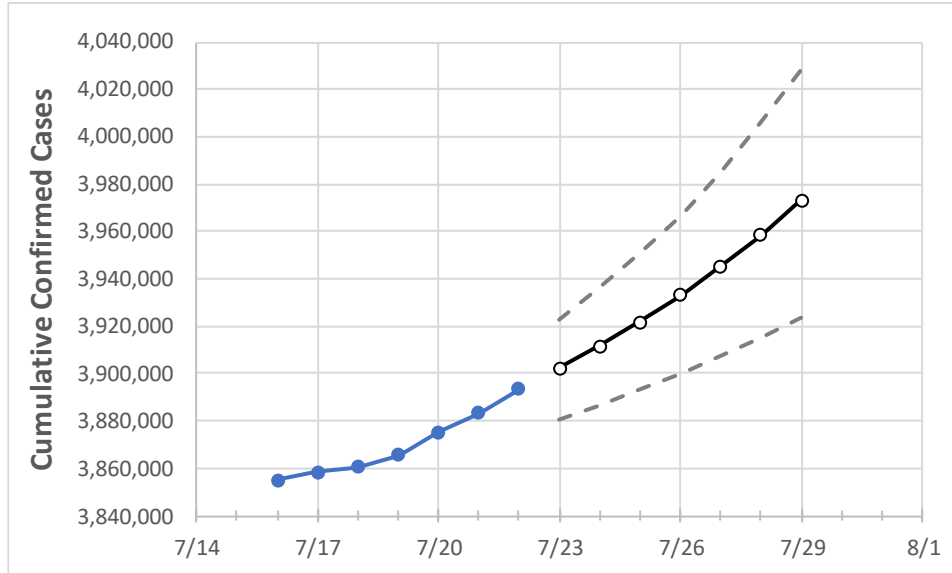
IEM's Modeling Lead

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:							
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29	
California	3,865,655	3,875,420	3,883,186	3,893,526	3,902,212	3,911,498	3,921,728	3,933,033	3,945,388	3,958,553	3,973,306	

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:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Alameda	92,584	92,973	93,361	97,459	97,797	98,150	98,544	98,949	99,379	99,870	100,367
Contra Costa	73,349	73,495	73,662	74,030	74,267	74,522	74,797	75,092	75,403	75,722	76,074
Fresno	103,298	103,350	103,438	103,504	103,598	103,698	103,804	103,918	104,039	104,166	104,303
Kern	111,894	111,979	112,063	112,063	112,156	112,255	112,360	112,473	112,591	112,719	112,854
Lake	3,825	3,848	3,871	3,945	3,994	4,050	4,114	4,185	4,269	4,365	4,472
Los Angeles	1,269,520	1,271,179	1,273,551	1,276,254	1,279,013	1,281,977	1,285,206	1,288,821	1,292,773	1,297,035	1,301,647
Marin	14,492	14,516	14,552	14,589	14,623	14,660	14,699	14,742	14,788	14,838	14,892
Monterey	44,182	44,208	44,243	44,273	44,303	44,334	44,368	44,403	44,440	44,478	44,519
Orange	277,126	277,489	277,845	278,209	278,641	279,103	279,599	280,128	280,699	281,308	281,957
Placer	24,313	24,359	24,483	24,483	24,535	24,586	24,641	24,697	24,759	24,823	24,884
Riverside	303,396	303,728	304,060	304,060	304,486	304,937	305,405	305,907	306,435	306,985	307,599
Sacramento	111,553	111,884	112,144	112,501	112,805	113,123	113,460	113,818	114,192	114,584	114,999
San Bernardino	302,429	303,166	303,350	303,673	303,983	304,303	304,646	305,033	305,432	305,882	306,361
San Diego	286,287	288,208	288,681	289,367	290,050	290,800	291,627	292,547	293,529	294,620	295,819
San Francisco	38,367	38,463	38,536	38,699	38,854	39,014	39,202	39,406	39,622	39,868	40,127
San Joaquin	75,927	76,034	76,034	76,034	76,156	76,285	76,428	76,578	76,739	76,907	77,095
San Luis Obispo	21,699	21,717	21,717	21,717	21,743	21,771	21,801	21,833	21,868	21,905	21,944
San Mateo	43,506	43,563	43,670	43,755	43,841	43,930	44,023	44,121	44,222	44,329	44,442
Santa Barbara	35,009	35,052	35,116	35,189	35,255	35,329	35,408	35,496	35,595	35,704	35,825
Santa Clara	121,007	121,159	121,304	121,553	121,766	122,000	122,251	122,529	122,821	123,135	123,477
Santa Cruz	16,425	16,434	16,443	16,452	16,465	16,478	16,492	16,507	16,522	16,538	16,554
Solano	34,728	34,761	34,885	34,885	34,961	35,040	35,125	35,214	35,305	35,403	35,506
Sonoma	31,838	31,875	31,905	31,965	32,016	32,069	32,121	32,175	32,229	32,284	32,339
Ventura	82,584	82,659	82,734	82,734	82,838	82,948	83,070	83,202	83,345	83,503	83,672

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:											
	7/19	7/20	7/21	7/22	7/24				7/26				7/28			
Alameda	92,584	92,973	93,361	97,459	98,150	(19,630)	[4,711]	{2,356}	98,949	(19,790)	[4,750]	{2,375}	99,870	(19,974)	[4,794]	{2,397}
Contra Costa	73,349	73,495	73,662	74,030	74,522	(14,904)	[3,577]	{1,789}	75,092	(15,018)	[3,604]	{1,802}	75,722	(15,144)	[3,635]	{1,817}
Fresno	103,298	103,350	103,438	103,504	103,698	(20,740)	[4,977]	{2,489}	103,918	(20,784)	[4,988]	{2,494}	104,166	(20,833)	[5,000]	{2,500}
Kern	111,894	111,979	112,063	112,063	112,255	(22,451)	[5,388]	{2,694}	112,473	(22,495)	[5,399]	{2,699}	112,719	(22,544)	[5,410]	{2,705}
Lake	3,825	3,848	3,871	3,945	4,050	(810)	[194]	{97}	4,185	(837)	[201]	{100}	4,365	(873)	[209]	{105}
Los Angeles	1,269,520	1,271,179	1,273,551	1,276,254	1,281,977	(256,395)	[61,535]	{30,767}	1,288,821	(257,764)	[61,863]	{30,932}	1,297,035	(259,407)	[62,258]	{31,129}
Marin	14,492	14,516	14,552	14,589	14,660	(2,932)	[704]	{352}	14,742	(2,948)	[708]	{354}	14,838	(2,968)	[712]	{356}
Monterey	44,182	44,208	44,243	44,273	44,334	(8,867)	[2,128]	{1,064}	44,403	(8,881)	[2,131]	{1,066}	44,478	(8,896)	[2,135]	{1,067}
Orange	277,126	277,489	277,845	278,209	279,103	(55,821)	[13,397]	{6,698}	280,128	(56,026)	[13,446]	{6,723}	281,308	(56,262)	[13,503]	{6,751}
Placer	24,313	24,359	24,483	24,483	24,586	(4,917)	[1,180]	{590}	24,697	(4,939)	[1,185]	{593}	24,823	(4,965)	[1,191]	{596}
Riverside	303,396	303,728	304,060	304,060	304,937	(60,987)	[14,637]	{7,318}	305,907	(61,181)	[14,684]	{7,342}	306,985	(61,397)	[14,735]	{7,368}
Sacramento	111,553	111,884	112,144	112,501	113,123	(22,625)	[5,430]	{2,715}	113,818	(22,764)	[5,463]	{2,732}	114,584	(22,917)	[5,500]	{2,750}
San Bernardino	302,429	303,166	303,350	303,673	304,303	(60,861)	[14,607]	{7,303}	305,033	(61,007)	[14,642]	{7,321}	305,882	(61,176)	[14,682]	{7,341}
San Diego	286,287	288,208	288,681	289,367	290,800	(58,160)	[13,958]	{6,979}	292,547	(58,509)	[14,042]	{7,021}	294,620	(58,924)	[14,142]	{7,071}
San Francisco	38,367	38,463	38,536	38,699	39,014	(7,803)	[1,873]	{936}	39,406	(7,881)	[1,892]	{946}	39,868	(7,974)	[1,914]	{957}
San Joaquin	75,927	76,034	76,034	76,034	76,285	(15,257)	[3,662]	{1,831}	76,578	(15,316)	[3,676]	{1,838}	76,907	(15,381)	[3,692]	{1,846}
San Luis Obispo	21,699	21,717	21,717	21,717	21,771	(4,354)	[1,045]	{523}	21,833	(4,367)	[1,048]	{524}	21,905	(4,381)	[1,051]	{526}
San Mateo	43,506	43,563	43,670	43,755	43,930	(8,786)	[2,109]	{1,054}	44,121	(8,824)	[2,118]	{1,059}	44,329	(8,866)	[2,128]	{1,064}
Santa Barbara	35,009	35,052	35,116	35,189	35,329	(7,066)	[1,696]	{848}	35,496	(7,099)	[1,704]	{852}	35,704	(7,141)	[1,714]	{857}
Santa Clara	121,007	121,159	121,304	121,553	122,000	(24,400)	[5,856]	{2,928}	122,529	(24,506)	[5,881]	{2,941}	123,135	(24,627)	[5,910]	{2,955}
Santa Cruz	16,425	16,434	16,443	16,452	16,478	(3,296)	[791]	{395}	16,507	(3,301)	[792]	{396}	16,538	(3,308)	[794]	{397}
Solano	34,728	34,761	34,885	34,885	35,040	(7,008)	[1,682]	{841}	35,214	(7,043)	[1,690]	{845}	35,403	(7,081)	[1,699]	{850}
Sonoma	31,838	31,875	31,905	31,965	32,069	(6,414)	[1,539]	{770}	32,175	(6,435)	[1,544]	{772}	32,284	(6,457)	[1,550]	{775}
Ventura	82,584	82,659	82,734	82,734	82,948	(16,590)	[3,982]	{1,991}	83,202	(16,640)	[3,994]	{1,997}	83,503	(16,701)	[4,008]	{2,004}

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.