

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

Date: 5/7/21

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 5/7/21 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.

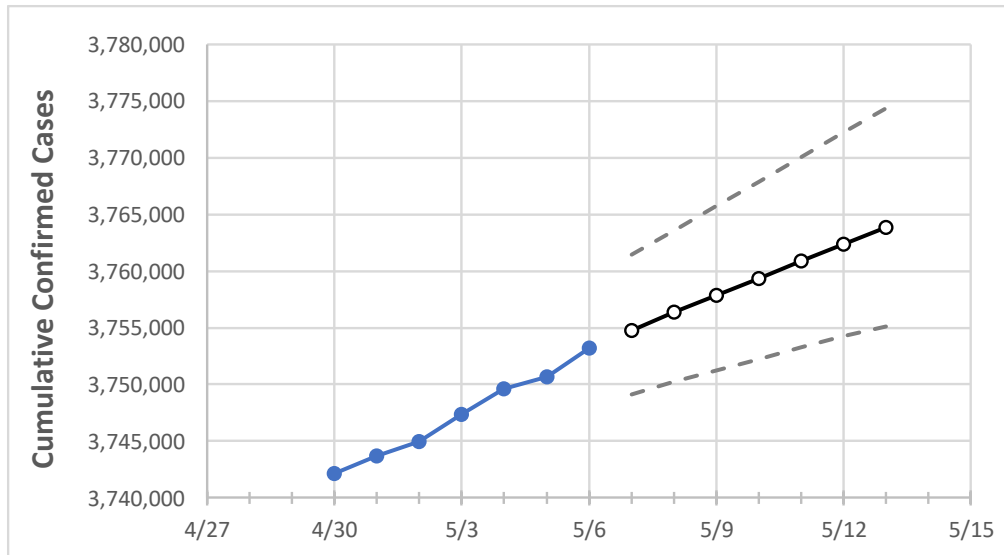
IEM's Modeling Lead

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:						
	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13
California	3,747,337	3,749,580	3,750,644	3,753,173	3,754,764	3,756,340	3,757,869	3,759,368	3,760,901	3,762,387	3,763,827

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:						
	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13
Alameda	86,784	87,326	87,372	87,407	87,481	87,555	87,623	87,694	87,762	87,828	87,892
Contra Costa	68,167	68,212	68,246	68,279	68,331	68,380	68,428	68,472	68,516	68,558	68,599
Fresno	101,372	101,405	101,451	101,491	101,531	101,571	101,609	101,648	101,685	101,722	101,759
Kern	108,652	108,719	108,822	108,887	108,937	108,985	109,034	109,083	109,130	109,177	109,223
Lake	3,443	3,446	3,454	3,458	3,461	3,463	3,466	3,468	3,471	3,473	3,475
Los Angeles	1,233,998	1,234,242	1,234,494	1,234,746	1,234,992	1,235,235	1,235,471	1,235,702	1,235,924	1,236,144	1,236,357
Marin	13,989	14,000	14,005	14,009	14,017	14,026	14,034	14,042	14,051	14,059	14,068
Monterey	43,476	43,490	43,498	43,506	43,515	43,525	43,534	43,543	43,552	43,561	43,570
Orange	270,345	270,444	270,507	270,569	270,640	270,709	270,775	270,840	270,905	270,968	271,029
Placer	22,323	22,358	22,386	22,532	22,573	22,616	22,661	22,705	22,752	22,797	22,844
Riverside	298,572	298,777	298,872	298,872	298,940	299,008	299,073	299,133	299,197	299,260	299,315
Sacramento	103,386	103,498	103,595	104,058	104,217	104,366	104,516	104,674	104,834	105,001	105,157
San Bernardino	296,146	296,188	296,257	296,324	296,382	296,436	296,489	296,541	296,590	296,636	296,685
San Diego	276,692	276,878	277,097	277,323	277,495	277,671	277,856	278,041	278,225	278,413	278,601
San Francisco	36,522	36,538	36,550	36,577	36,603	36,629	36,655	36,680	36,705	36,730	36,755
San Joaquin	72,672	72,724	72,754	72,784	72,843	72,900	72,956	73,013	73,065	73,122	73,174
San Luis Obispo	21,196	21,222	21,233	21,243	21,255	21,265	21,276	21,287	21,297	21,308	21,317
San Mateo	41,656	41,689	41,708	41,755	41,788	41,820	41,851	41,882	41,912	41,944	41,976
Santa Barbara	34,238	34,250	34,256	34,261	34,277	34,293	34,309	34,324	34,339	34,354	34,368
Santa Clara	118,479	118,541	118,593	118,698	118,765	118,830	118,892	118,954	119,013	119,071	119,127
Santa Cruz	16,017	16,023	16,029	16,062	16,081	16,098	16,117	16,136	16,154	16,173	16,191
Solano	32,588	32,613	32,642	32,698	32,737	32,775	32,813	32,851	32,890	32,928	32,965
Sonoma	29,897	29,910	29,921	29,951	29,965	29,979	29,993	30,006	30,020	30,034	30,047
Ventura	80,693	80,748	80,776	80,812	80,840	80,868	80,896	80,924	80,952	80,981	81,009

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:											
	5/3	5/4	5/5	5/6	5/8				5/10				5/12			
Alameda	86,784	87,326	87,372	87,407	87,555	(17,511)	[4,203]	{2,101}	87,694	(17,539)	[4,209]	{2,105}	87,828	(17,566)	[4,216]	{2,108}
Contra Costa	68,167	68,212	68,246	68,279	68,380	(13,676)	[3,282]	{1,641}	68,472	(13,694)	[3,287]	{1,643}	68,558	(13,712)	[3,291]	{1,645}
Fresno	101,372	101,405	101,451	101,491	101,571	(20,314)	[4,875]	{2,438}	101,648	(20,330)	[4,879]	{2,440}	101,722	(20,344)	[4,883]	{2,441}
Kern	108,652	108,719	108,822	108,887	108,985	(21,797)	[5,231]	{2,616}	109,083	(21,817)	[5,236]	{2,618}	109,177	(21,835)	[5,240]	{2,620}
Lake	3,443	3,446	3,454	3,458	3,463	(693)	[166]	{83}	3,468	(694)	[166]	{83}	3,473	(695)	[167]	{83}
Los Angeles	1,233,998	1,234,242	1,234,494	1,234,746	1,235,235	(247,047)	[59,291]	{29,646}	1,235,702	(247,140)	[59,314]	{29,657}	1,236,144	(247,229)	[59,335]	{29,667}
Marin	13,989	14,000	14,005	14,009	14,026	(2,805)	[673]	{337}	14,042	(2,808)	[674]	{337}	14,059	(2,812)	[675]	{337}
Monterey	43,476	43,490	43,498	43,506	43,525	(8,705)	[2,089]	{1,045}	43,543	(8,709)	[2,090]	{1,045}	43,561	(8,712)	[2,091]	{1,045}
Orange	270,345	270,444	270,507	270,569	270,709	(54,142)	[12,994]	{6,497}	270,840	(54,168)	[13,000]	{6,500}	270,968	(54,194)	[13,006]	{6,503}
Placer	22,323	22,358	22,386	22,532	22,616	(4,523)	[1,086]	{543}	22,705	(4,541)	[1,090]	{545}	22,797	(4,559)	[1,094]	{547}
Riverside	298,572	298,777	298,872	298,872	299,008	(59,802)	[14,352]	{7,176}	299,133	(59,827)	[14,358]	{7,179}	299,260	(59,852)	[14,364]	{7,182}
Sacramento	103,386	103,498	103,595	104,058	104,366	(20,873)	[5,010]	{2,505}	104,674	(20,935)	[5,024]	{2,512}	105,001	(21,000)	[5,040]	{2,520}
San Bernardino	296,146	296,188	296,257	296,324	296,436	(59,287)	[14,229]	{7,114}	296,541	(59,308)	[14,234]	{7,117}	296,636	(59,327)	[14,239]	{7,119}
San Diego	276,692	276,878	277,097	277,323	277,671	(55,534)	[13,328]	{6,664}	278,041	(55,608)	[13,346]	{6,673}	278,413	(55,683)	[13,364]	{6,682}
San Francisco	36,522	36,538	36,550	36,577	36,629	(7,326)	[1,758]	{879}	36,680	(7,336)	[1,761]	{880}	36,730	(7,346)	[1,763]	{882}
San Joaquin	72,672	72,724	72,754	72,784	72,900	(14,580)	[3,499]	{1,750}	73,013	(14,603)	[3,505]	{1,752}	73,122	(14,624)	[3,510]	{1,755}
San Luis Obispo	21,196	21,222	21,233	21,243	21,265	(4,253)	[1,021]	{510}	21,287	(4,257)	[1,022]	{511}	21,308	(4,262)	[1,023]	{511}
San Mateo	41,656	41,689	41,708	41,755	41,820	(8,364)	[2,007]	{1,004}	41,882	(8,376)	[2,010]	{1,005}	41,944	(8,389)	[2,013]	{1,007}
Santa Barbara	34,238	34,250	34,256	34,261	34,293	(6,859)	[1,646]	{823}	34,324	(6,865)	[1,648]	{824}	34,354	(6,871)	[1,649]	{825}
Santa Clara	118,479	118,541	118,593	118,698	118,830	(23,766)	[5,704]	{2,852}	118,954	(23,791)	[5,710]	{2,855}	119,071	(23,814)	[5,715]	{2,858}
Santa Cruz	16,017	16,023	16,029	16,062	16,098	(3,220)	[773]	{386}	16,136	(3,227)	[775]	{387}	16,173	(3,235)	[776]	{388}
Solano	32,588	32,613	32,642	32,698	32,775	(6,555)	[1,573]	{787}	32,851	(6,570)	[1,577]	{788}	32,928	(6,586)	[1,581]	{790}
Sonoma	29,897	29,910	29,921	29,951	29,979	(5,996)	[1,439]	{719}	30,006	(6,001)	[1,440]	{720}	30,034	(6,007)	[1,442]	{721}
Ventura	80,693	80,748	80,776	80,812	80,868	(16,174)	[3,882]	{1,941}	80,924	(16,185)	[3,884]	{1,942}	80,981	(16,196)	[3,887]	{1,944}

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.