

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

Date: 6/7/21

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 6/7/21 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.

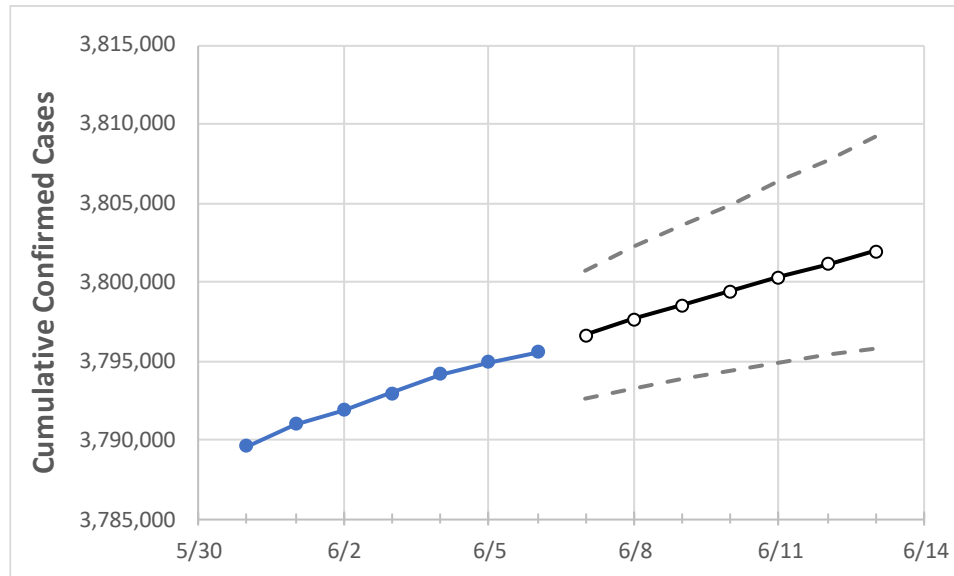
IEM's Modeling Lead

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:							
	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	
California	3,792,962	3,794,129	3,794,927	3,795,580	3,796,604	3,797,609	3,798,507	3,799,419	3,800,303	3,801,138	3,801,955	

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:						
	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13
Alameda	89,025	89,091	89,129	89,141	89,170	89,198	89,225	89,251	89,275	89,298	89,320
Contra Costa	69,791	69,827	69,886	69,945	69,982	70,018	70,056	70,091	70,126	70,161	70,195
Fresno	102,547	102,566	102,601	102,626	102,648	102,668	102,688	102,706	102,725	102,742	102,759
Kern	110,252	110,302	110,350	110,372	110,415	110,456	110,499	110,541	110,583	110,622	110,663
Lake	3,522	3,526	3,528	3,534	3,537	3,541	3,544	3,548	3,552	3,555	3,560
Los Angeles	1,244,473	1,244,684	1,244,917	1,245,120	1,245,290	1,245,460	1,245,627	1,245,797	1,245,964	1,246,136	1,246,303
Marin	14,152	14,151	14,153	14,156	14,161	14,165	14,170	14,175	14,179	14,184	14,189
Monterey	43,758	43,766	43,766	43,766	43,771	43,775	43,780	43,784	43,788	43,792	43,796
Orange	272,242	272,298	272,361	272,426	272,478	272,531	272,586	272,641	272,695	272,748	272,802
Placer	23,118	23,127	23,130	23,133	23,146	23,159	23,171	23,184	23,196	23,208	23,220
Riverside	300,879	300,929	300,929	300,929	300,965	300,997	301,030	301,061	301,091	301,120	301,150
Sacramento	106,635	106,714	106,714	106,714	106,777	106,839	106,899	106,959	107,014	107,071	107,126
San Bernardino	298,599	298,643	298,656	298,676	298,731	298,787	298,843	298,894	298,948	298,998	299,047
San Diego	280,429	280,555	280,675	280,742	280,814	280,885	280,957	281,028	281,095	281,163	281,230
San Francisco	37,050	37,072	37,079	37,111	37,124	37,137	37,150	37,163	37,176	37,188	37,202
San Joaquin	74,060	74,114	74,114	74,114	74,155	74,196	74,239	74,279	74,322	74,362	74,404
San Luis Obispo	21,351	21,363	21,363	21,363	21,370	21,378	21,385	21,393	21,402	21,409	21,417
San Mateo	42,390	42,396	42,413	42,433	42,445	42,455	42,466	42,476	42,485	42,494	42,502
Santa Barbara	34,513	34,526	34,531	34,531	34,536	34,540	34,545	34,549	34,553	34,557	34,561
Santa Clara	119,553	119,592	119,619	119,676	119,699	119,721	119,743	119,764	119,786	119,807	119,827
Santa Cruz	16,187	16,190	16,190	16,190	16,192	16,194	16,196	16,198	16,200	16,201	16,203
Solano	33,469	33,491	33,491	33,491	33,524	33,557	33,590	33,624	33,660	33,696	33,732
Sonoma	30,422	30,454	30,493	30,493	30,524	30,557	30,591	30,628	30,666	30,705	30,748
Ventura	81,421	81,457	81,457	81,457	81,471	81,484	81,496	81,509	81,521	81,533	81,545

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:											
	6/3	6/4	6/5	6/6	6/8				6/10				6/12			
Alameda	89,025	89,091	89,129	89,141	89,198	(17,840)	[4,281]	{2,141}	89,251	(17,850)	[4,284]	{2,142}	89,298	(17,860)	[4,286]	{2,143}
Contra Costa	69,791	69,827	69,886	69,945	70,018	(14,004)	[3,361]	{1,680}	70,091	(14,018)	[3,364]	{1,682}	70,161	(14,032)	[3,368]	{1,684}
Fresno	102,547	102,566	102,601	102,626	102,668	(20,534)	[4,928]	{2,464}	102,706	(20,541)	[4,930]	{2,465}	102,742	(20,548)	[4,932]	{2,466}
Kern	110,252	110,302	110,350	110,372	110,456	(22,091)	[5,302]	{2,651}	110,541	(22,108)	[5,306]	{2,653}	110,622	(22,124)	[5,310]	{2,655}
Lake	3,522	3,526	3,528	3,534	3,541	(708)	[170]	{85}	3,548	(710)	[170]	{85}	3,555	(711)	[171]	{85}
Los Angeles	1,244,473	1,244,684	1,244,917	1,245,120	1,245,460	(249,092)	[59,782]	{29,891}	1,245,797	(249,159)	[59,798]	{29,899}	1,246,136	(249,227)	[59,815]	{29,907}
Marin	14,152	14,151	14,153	14,156	14,165	(2,833)	[680]	{340}	14,175	(2,835)	[680]	{340}	14,184	(2,837)	[681]	{340}
Monterey	43,758	43,766	43,766	43,766	43,775	(8,755)	[2,101]	{1,051}	43,784	(8,757)	[2,102]	{1,051}	43,792	(8,758)	[2,102]	{1,051}
Orange	272,242	272,298	272,361	272,426	272,531	(54,506)	[13,081]	{6,541}	272,641	(54,528)	[13,087]	{6,543}	272,748	(54,550)	[13,092]	{6,546}
Placer	23,118	23,127	23,130	23,133	23,159	(4,632)	[1,112]	{556}	23,184	(4,637)	[1,113]	{556}	23,208	(4,642)	[1,114]	{557}
Riverside	300,879	300,929	300,929	300,929	300,997	(60,199)	[14,448]	{7,224}	301,061	(60,212)	[14,451]	{7,225}	301,120	(60,224)	[14,454]	{7,227}
Sacramento	106,635	106,714	106,714	106,714	106,839	(21,368)	[5,128]	{2,564}	106,959	(21,392)	[5,134]	{2,567}	107,071	(21,414)	[5,139]	{2,570}
San Bernardino	298,599	298,643	298,656	298,676	298,787	(59,757)	[14,342]	{7,171}	298,894	(59,779)	[14,347]	{7,173}	298,998	(59,800)	[14,352]	{7,176}
San Diego	280,429	280,555	280,675	280,742	280,885	(56,177)	[13,483]	{6,741}	281,028	(56,206)	[13,489]	{6,745}	281,163	(56,233)	[13,496]	{6,748}
San Francisco	37,050	37,072	37,079	37,111	37,137	(7,427)	[1,783]	{891}	37,163	(7,433)	[1,784]	{892}	37,188	(7,438)	[1,785]	{893}
San Joaquin	74,060	74,114	74,114	74,114	74,196	(14,839)	[3,561]	{1,781}	74,279	(14,856)	[3,565]	{1,783}	74,362	(14,872)	[3,569]	{1,785}
San Luis Obispo	21,351	21,363	21,363	21,363	21,378	(4,276)	[1,026]	{513}	21,393	(4,279)	[1,027]	{513}	21,409	(4,282)	[1,028]	{514}
San Mateo	42,390	42,396	42,413	42,433	42,455	(8,491)	[2,038]	{1,019}	42,476	(8,495)	[2,039]	{1,019}	42,494	(8,499)	[2,040]	{1,020}
Santa Barbara	34,513	34,526	34,531	34,531	34,540	(6,908)	[1,658]	{829}	34,549	(6,910)	[1,658]	{829}	34,557	(6,911)	[1,659]	{829}
Santa Clara	119,553	119,592	119,619	119,676	119,721	(23,944)	[5,747]	{2,873}	119,764	(23,953)	[5,749]	{2,874}	119,807	(23,961)	[5,751]	{2,875}
Santa Cruz	16,187	16,190	16,190	16,190	16,194	(3,239)	[777]	{389}	16,198	(3,240)	[778]	{389}	16,201	(3,240)	[778]	{389}
Solano	33,469	33,491	33,491	33,491	33,557	(6,711)	[1,611]	{805}	33,624	(6,725)	[1,614]	{807}	33,696	(6,739)	[1,617]	{809}
Sonoma	30,422	30,454	30,493	30,493	30,557	(6,111)	[1,467]	{733}	30,628	(6,126)	[1,470]	{735}	30,705	(6,141)	[1,474]	{737}
Ventura	81,421	81,457	81,457	81,457	81,484	(16,297)	[3,911]	{1,956}	81,509	(16,302)	[3,912]	{1,956}	81,533	(16,307)	[3,914]	{1,957}

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.