

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

Date: 4/14/21

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 4/14/21 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.**

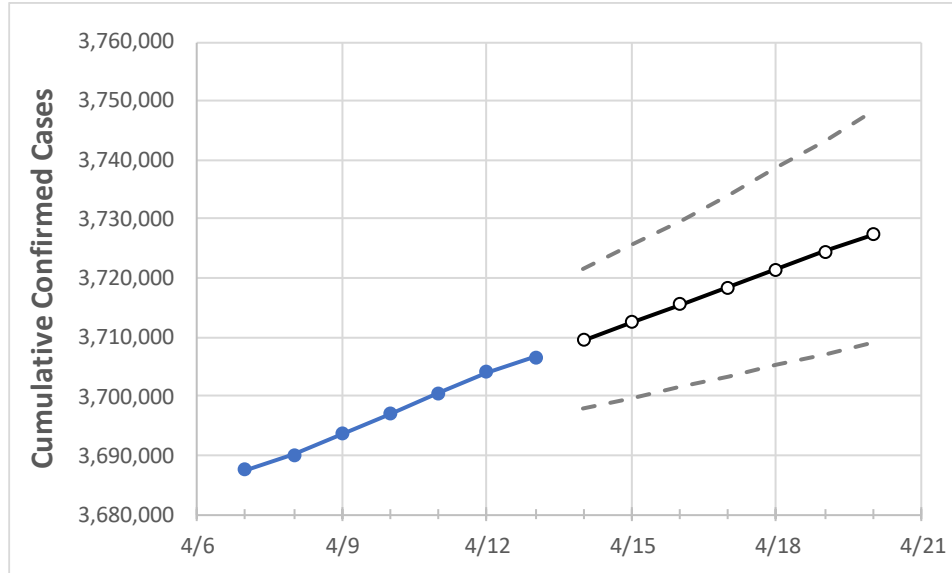
### IEM's Modeling Lead

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:						
	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20
California	3,696,980	3,700,471	3,704,070	3,706,629	3,709,545	3,712,496	3,715,485	3,718,457	3,721,458	3,724,451	3,727,388

*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:							
	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	
Alameda	84,448	84,626	84,756	84,817	84,924	85,031	85,140	85,251	85,368	85,483	85,600	
Contra Costa	66,262	66,369	66,442	66,567	66,663	66,763	66,861	66,961	67,062	67,165	67,268	
Fresno	100,027	100,135	100,230	100,277	100,351	100,425	100,497	100,567	100,638	100,703	100,771	
Kern	107,172	107,341	107,374	107,434	107,522	107,611	107,703	107,796	107,885	107,979	108,072	
Lake	3,362	3,368	3,377	3,380	3,384	3,388	3,391	3,395	3,398	3,402	3,406	
Los Angeles	1,225,299	1,225,796	1,226,219	1,226,627	1,227,125	1,227,618	1,228,102	1,228,591	1,229,061	1,229,536	1,230,021	
Marin	13,797	13,806	13,813	13,815	13,823	13,831	13,839	13,847	13,855	13,862	13,869	
Monterey	43,157	43,174	43,192	43,209	43,227	43,247	43,266	43,284	43,302	43,320	43,340	
Orange	267,957	268,175	268,304	268,414	268,594	268,779	268,967	269,158	269,350	269,542	269,738	
Placer	21,396	21,402	21,540	21,600	21,648	21,696	21,746	21,797	21,849	21,904	21,960	
Riverside	296,272	296,453	296,635	296,801	297,000	297,200	297,408	297,612	297,822	298,036	298,252	
Sacramento	99,722	100,048	100,365	100,587	100,830	101,079	101,338	101,599	101,867	102,143	102,428	
San Bernardino	292,558	293,638	293,835	293,925	294,223	294,537	294,865	295,207	295,559	295,936	296,330	
San Diego	273,057	273,286	273,430	273,708	273,955	274,198	274,443	274,675	274,910	275,140	275,374	
San Francisco	35,716	35,774	35,815	35,841	35,881	35,922	35,964	36,006	36,049	36,090	36,132	
San Joaquin	70,829	70,911	70,994	71,178	71,279	71,378	71,484	71,589	71,697	71,806	71,910	
San Luis Obispo	20,733	20,744	20,754	20,827	20,851	20,876	20,900	20,924	20,949	20,974	20,997	
San Mateo	40,800	40,878	40,901	40,920	40,959	40,997	41,037	41,076	41,116	41,154	41,193	
Santa Barbara	33,655	33,704	33,727	33,736	33,776	33,815	33,856	33,896	33,938	33,983	34,026	
Santa Clara	116,084	116,228	116,324	116,436	116,573	116,710	116,854	116,998	117,148	117,288	117,439	
Santa Cruz	15,347	15,360	15,394	15,432	15,457	15,481	15,506	15,531	15,556	15,582	15,609	
Solano	31,576	31,624	31,673	31,702	31,740	31,780	31,819	31,856	31,894	31,933	31,973	
Sonoma	29,501	29,525	29,536	29,573	29,593	29,612	29,631	29,650	29,669	29,689	29,709	
Ventura	80,001	80,040	80,078	80,112	80,141	80,170	80,199	80,226	80,253	80,280	80,305	

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:											
	4/10	4/11	4/12	4/13	4/15				4/17				4/19			
Alameda	84,448	84,626	84,756	84,817	85,031	(17,006)	[4,081]	{2,041}	85,251	(17,050)	[4,092]	{2,046}	85,483	(17,097)	[4,103]	{2,052}
Contra Costa	66,262	66,369	66,442	66,567	66,763	(13,353)	[3,205]	{1,602}	66,961	(13,392)	[3,214]	{1,607}	67,165	(13,433)	[3,224]	{1,612}
Fresno	100,027	100,135	100,230	100,277	100,425	(20,085)	[4,820]	{2,410}	100,567	(20,113)	[4,827]	{2,414}	100,703	(20,141)	[4,834]	{2,417}
Kern	107,172	107,341	107,374	107,434	107,611	(21,522)	[5,165]	{2,583}	107,796	(21,559)	[5,174]	{2,587}	107,979	(21,596)	[5,183]	{2,591}
Lake	3,362	3,368	3,377	3,380	3,388	(678)	[163]	{81}	3,395	(679)	[163]	{81}	3,402	(680)	[163]	{82}
Los Angeles	1,225,299	1,225,796	1,226,219	1,226,627	1,227,618	(245,524)	[58,926]	{29,463}	1,228,591	(245,718)	[58,972]	{29,486}	1,229,536	(245,907)	[59,018]	{29,509}
Marin	13,797	13,806	13,813	13,815	13,831	(2,766)	[664]	{332}	13,847	(2,769)	[665]	{332}	13,862	(2,772)	[665]	{333}
Monterey	43,157	43,174	43,192	43,209	43,247	(8,649)	[2,076]	{1,038}	43,284	(8,657)	[2,078]	{1,039}	43,320	(8,664)	[2,079]	{1,040}
Orange	267,957	268,175	268,304	268,414	268,779	(53,756)	[12,901]	{6,451}	269,158	(53,832)	[12,920]	{6,460}	269,542	(53,908)	[12,938]	{6,469}
Placer	21,396	21,402	21,540	21,600	21,696	(4,339)	[1,041]	{521}	21,797	(4,359)	[1,046]	{523}	21,904	(4,381)	[1,051]	{526}
Riverside	296,272	296,453	296,635	296,801	297,200	(59,440)	[14,266]	{7,133}	297,612	(59,522)	[14,285]	{7,143}	298,036	(59,607)	[14,306]	{7,153}
Sacramento	99,722	100,048	100,365	100,587	101,079	(20,216)	[4,852]	{2,426}	101,599	(20,320)	[4,877]	{2,438}	102,143	(20,429)	[4,903]	{2,451}
San Bernardino	292,558	293,638	293,835	293,925	294,537	(58,907)	[14,138]	{7,069}	295,207	(59,041)	[14,170]	{7,085}	295,936	(59,187)	[14,205]	{7,102}
San Diego	273,057	273,286	273,430	273,708	274,198	(54,840)	[13,161]	{6,581}	274,675	(54,935)	[13,184]	{6,592}	275,140	(55,028)	[13,207]	{6,603}
San Francisco	35,716	35,774	35,815	35,841	35,922	(7,184)	[1,724]	{862}	36,006	(7,201)	[1,728]	{864}	36,090	(7,218)	[1,732]	{866}
San Joaquin	70,829	70,911	70,994	71,178	71,378	(14,276)	[3,426]	{1,713}	71,589	(14,318)	[3,436]	{1,718}	71,806	(14,361)	[3,447]	{1,723}
San Luis Obispo	20,733	20,744	20,754	20,827	20,876	(4,175)	[1,002]	{501}	20,924	(4,185)	[1,004]	{502}	20,974	(4,195)	[1,007]	{503}
San Mateo	40,800	40,878	40,901	40,920	40,997	(8,199)	[1,968]	{984}	41,076	(8,215)	[1,972]	{986}	41,154	(8,231)	[1,975]	{988}
Santa Barbara	33,655	33,704	33,727	33,736	33,815	(6,763)	[1,623]	{812}	33,896	(6,779)	[1,627]	{814}	33,983	(6,797)	[1,631]	{816}
Santa Clara	116,084	116,228	116,324	116,436	116,710	(23,342)	[5,602]	{2,801}	116,998	(23,400)	[5,616]	{2,808}	117,288	(23,458)	[5,630]	{2,815}
Santa Cruz	15,347	15,360	15,394	15,432	15,481	(3,096)	[743]	{372}	15,531	(3,106)	[745]	{373}	15,582	(3,116)	[748]	{374}
Solano	31,576	31,624	31,673	31,702	31,780	(6,356)	[1,525]	{763}	31,856	(6,371)	[1,529]	{765}	31,933	(6,387)	[1,533]	{766}
Sonoma	29,501	29,525	29,536	29,573	29,612	(5,922)	[1,421]	{711}	29,650	(5,930)	[1,423]	{712}	29,689	(5,938)	[1,425]	{713}
Ventura	80,001	80,040	80,078	80,112	80,170	(16,034)	[3,848]	{1,924}	80,226	(16,045)	[3,851]	{1,925}	80,280	(16,056)	[3,853]	{1,927}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.