

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

Date: 10/6/21

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 10/6/21 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.**

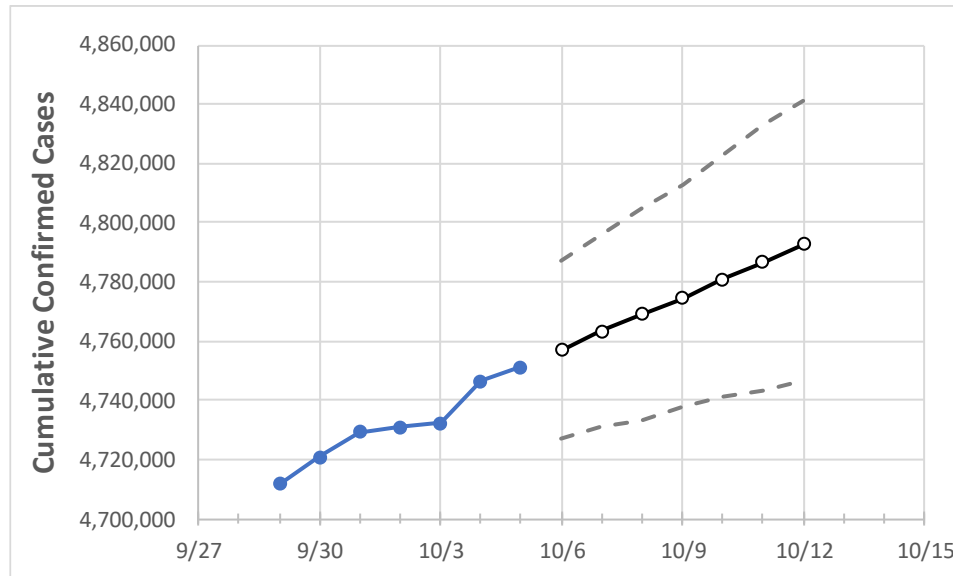
### IEM's Modeling Lead

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:							
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	
California	4,731,043	4,732,419	4,746,601	4,751,206	4,757,090	4,763,372	4,768,966	4,774,385	4,780,749	4,786,580	4,792,711	

*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:						
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12
Alameda	118,187	118,375	118,564	118,658	118,806	118,953	119,102	119,253	119,396	119,539	119,687
Contra Costa	97,591	97,764	97,938	98,006	98,139	98,268	98,395	98,520	98,649	98,774	98,900
Fresno	140,040	140,345	140,650	140,950	141,248	141,542	141,847	142,145	142,440	142,736	143,037
Kern	139,827	140,100	140,373	140,649	140,912	141,179	141,427	141,684	141,936	142,190	142,426
Lake	6,317	6,333	6,349	6,358	6,375	6,391	6,408	6,425	6,440	6,457	6,473
Los Angeles	1,462,013	1,463,039	1,463,889	1,464,793	1,465,924	1,467,021	1,468,072	1,469,150	1,470,232	1,471,236	1,472,272
Marin	17,369	17,388	17,408	17,421	17,438	17,455	17,471	17,488	17,504	17,520	17,537
Monterey	50,236	50,265	50,293	50,302	50,348	50,397	50,438	50,491	50,532	50,584	50,629
Orange	319,681	319,905	320,128	320,292	320,658	321,033	321,385	321,744	322,123	322,471	322,839
Placer	37,815	37,888	37,961	37,995	38,064	38,130	38,189	38,257	38,321	38,394	38,445
Riverside	364,405	364,861	365,316	365,551	365,986	366,427	366,862	367,256	367,672	368,145	368,552
Sacramento	154,236	154,491	154,747	154,970	155,227	155,466	155,712	155,944	156,169	156,392	156,635
San Bernardino	352,326	352,690	353,053	353,053	353,385	353,729	354,072	354,379	354,734	355,081	355,383
San Diego	357,776	358,126	358,498	359,167	359,738	360,309	360,881	361,448	362,001	362,567	363,107
San Francisco	53,032	53,146	53,259	53,324	53,411	53,496	53,584	53,671	53,758	53,843	53,927
San Joaquin	99,948	100,126	100,304	100,369	100,524	100,669	100,819	100,962	101,103	101,246	101,384
San Luis Obispo	29,125	29,175	29,225	29,250	29,304	29,356	29,407	29,459	29,509	29,560	29,611
San Mateo	53,158	53,210	53,262	53,297	53,355	53,412	53,467	53,524	53,578	53,635	53,688
Santa Barbara	44,090	44,133	44,175	44,210	44,269	44,334	44,383	44,442	44,496	44,560	44,619
Santa Clara	142,555	142,723	142,892	142,995	143,135	143,281	143,412	143,557	143,672	143,840	143,962
Santa Cruz	20,543	20,572	20,601	20,612	20,643	20,674	20,702	20,733	20,765	20,795	20,827
Solano	45,024	45,107	45,191	45,232	45,294	45,356	45,409	45,469	45,528	45,590	45,644
Sonoma	40,062	40,122	40,183	40,224	40,275	40,325	40,373	40,424	40,474	40,523	40,574
Ventura	99,220	99,304	99,389	99,451	99,529	99,617	99,697	99,774	99,862	99,948	100,025

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:											
	10/2	10/3	10/4	10/5	10/7				10/9				10/11			
Alameda	118,187	118,375	118,564	118,658	118,953	(23,791)	[5,710]	{2,855}	119,253	(23,851)	[5,724]	{2,862}	119,539	(23,908)	[5,738]	{2,869}
Contra Costa	97,591	97,764	97,938	98,006	98,268	(19,654)	[4,717]	{2,358}	98,520	(19,704)	[4,729]	{2,364}	98,774	(19,755)	[4,741]	{2,371}
Fresno	140,040	140,345	140,650	140,950	141,542	(28,308)	[6,794]	{3,397}	142,145	(28,429)	[6,823]	{3,411}	142,736	(28,547)	[6,851]	{3,426}
Kern	139,827	140,100	140,373	140,649	141,179	(28,236)	[6,777]	{3,388}	141,684	(28,337)	[6,801]	{3,400}	142,190	(28,438)	[6,825]	{3,413}
Lake	6,317	6,333	6,349	6,358	6,391	(1,278)	[307]	{153}	6,425	(1,285)	[308]	{154}	6,457	(1,291)	[310]	{155}
Los Angeles	1,462,013	1,463,039	1,463,889	1,464,793	1,467,021	(293,404)	[70,417]	{35,208}	1,469,150	(293,830)	[70,519]	{35,260}	1,471,236	(294,247)	[70,619]	{35,310}
Marin	17,369	17,388	17,408	17,421	17,455	(3,491)	[838]	{419}	17,488	(3,498)	[839]	{420}	17,520	(3,504)	[841]	{420}
Monterey	50,236	50,265	50,293	50,302	50,397	(10,079)	[2,419]	{1,210}	50,491	(10,098)	[2,424]	{1,212}	50,584	(10,117)	[2,428]	{1,214}
Orange	319,681	319,905	320,128	320,292	321,033	(64,207)	[15,410]	{7,705}	321,744	(64,349)	[15,444]	{7,722}	322,471	(64,494)	[15,479]	{7,739}
Placer	37,815	37,888	37,961	37,995	38,130	(7,626)	[1,830]	{915}	38,257	(7,651)	[1,836]	{918}	38,394	(7,679)	[1,843]	{921}
Riverside	364,405	364,861	365,316	365,551	366,427	(73,285)	[17,589]	{8,794}	367,256	(73,451)	[17,628]	{8,814}	368,145	(73,629)	[17,671]	{8,835}
Sacramento	154,236	154,491	154,747	154,970	155,466	(31,093)	[7,462]	{3,731}	155,944	(31,189)	[7,485]	{3,743}	156,392	(31,278)	[7,507]	{3,753}
San Bernardino	352,326	352,690	353,053	353,053	353,729	(70,746)	[16,979]	{8,490}	354,379	(70,876)	[17,010]	{8,505}	355,081	(71,016)	[17,044]	{8,522}
San Diego	357,776	358,126	358,498	359,167	360,309	(72,062)	[17,295]	{8,647}	361,448	(72,290)	[17,349]	{8,675}	362,567	(72,513)	[17,403]	{8,702}
San Francisco	53,032	53,146	53,259	53,324	53,496	(10,699)	[2,568]	{1,284}	53,671	(10,734)	[2,576]	{1,288}	53,843	(10,769)	[2,584]	{1,292}
San Joaquin	99,948	100,126	100,304	100,369	100,669	(20,134)	[4,832]	{2,416}	100,962	(20,192)	[4,846]	{2,423}	101,246	(20,249)	[4,860]	{2,430}
San Luis Obispo	29,125	29,175	29,225	29,250	29,356	(5,871)	[1,409]	{705}	29,459	(5,892)	[1,414]	{707}	29,560	(5,912)	[1,419]	{709}
San Mateo	53,158	53,210	53,262	53,297	53,412	(10,682)	[2,564]	{1,282}	53,524	(10,705)	[2,569]	{1,285}	53,635	(10,727)	[2,574]	{1,287}
Santa Barbara	44,090	44,133	44,175	44,210	44,334	(8,867)	[2,128]	{1,064}	44,442	(8,888)	[2,133]	{1,067}	44,560	(8,912)	[2,139]	{1,069}
Santa Clara	142,555	142,723	142,892	142,995	143,281	(28,656)	[6,877]	{3,439}	143,557	(28,711)	[6,891]	{3,445}	143,840	(28,768)	[6,904]	{3,452}
Santa Cruz	20,543	20,572	20,601	20,612	20,674	(4,135)	[992]	{496}	20,733	(4,147)	[995]	{498}	20,795	(4,159)	[998]	{499}
Solano	45,024	45,107	45,191	45,232	45,356	(9,071)	[2,177]	{1,089}	45,469	(9,094)	[2,182]	{1,091}	45,590	(9,118)	[2,188]	{1,094}
Sonoma	40,062	40,122	40,183	40,224	40,325	(8,065)	[1,936]	{968}	40,424	(8,085)	[1,940]	{970}	40,523	(8,105)	[1,945]	{973}
Ventura	99,220	99,304	99,389	99,451	99,617	(19,923)	[4,782]	{2,391}	99,774	(19,955)	[4,789]	{2,395}	99,948	(19,990)	[4,798]	{2,399}

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.