

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

Date: 1/27/21

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 1/27/21 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.**

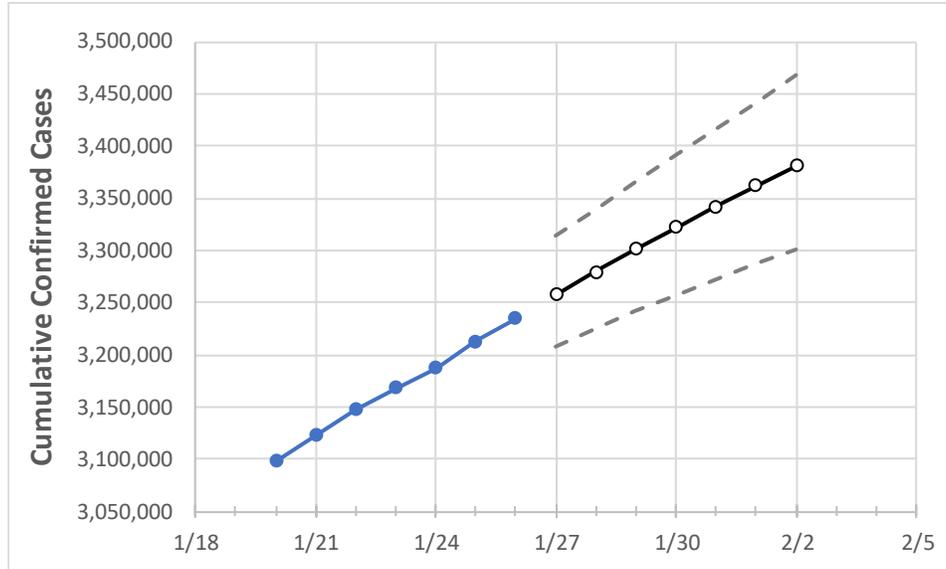
### IEM's Modeling Lead

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:							
	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	

California	3,168,028	3,187,475	3,213,222	3,235,045	3,257,706	3,279,554	3,301,471	3,322,046	3,342,396	3,361,981	3,380,865
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*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:							
	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	
Alameda	69,693	70,334	70,823	71,298	72,003	72,691	73,367	74,048	74,720	75,372	76,029	
Contra Costa	54,416	54,951	55,245	55,593	56,000	56,408	56,810	57,200	57,583	57,938	58,303	
Fresno	84,744	85,274	85,808	86,336	86,918	87,502	88,073	88,621	89,152	89,694	90,219	
Kern	89,095	90,213	90,564	91,119	91,747	92,349	92,926	93,489	94,050	94,590	95,134	
Lake	2,681	2,673	2,724	2,729	2,788	2,848	2,909	2,972	3,040	3,108	3,177	
Los Angeles	1,065,505	1,073,156	1,079,672	1,085,488	1,093,442	1,101,230	1,108,918	1,116,199	1,123,166	1,129,936	1,136,543	
Marin	11,930	11,954	12,024	12,067	12,131	12,193	12,251	12,310	12,367	12,419	12,473	
Monterey	37,285	37,406	37,527	38,434	38,755	39,067	39,359	39,662	39,966	40,263	40,544	
Orange	237,292	237,666	237,708	239,175	240,157	241,110	242,008	242,858	243,610	244,350	245,072	
Placer	17,730	17,784	17,839	18,034	18,139	18,238	18,340	18,436	18,527	18,616	18,700	
Riverside	260,476	262,419	264,363	266,849	269,443	272,002	274,500	277,163	279,597	282,243	284,761	
Sacramento	82,861	83,408	84,110	84,653	85,310	85,963	86,577	87,181	87,782	88,375	88,947	
San Bernardino	262,858	264,457	266,028	268,542	270,472	272,352	274,192	276,062	277,871	279,563	281,263	
San Diego	225,558	227,195	228,632	230,066	231,969	233,850	235,631	237,378	239,073	240,733	242,386	
San Francisco	30,027	30,308	30,559	30,734	30,947	31,154	31,352	31,553	31,744	31,933	32,119	
San Joaquin	59,485	59,575	59,665	60,545	60,921	61,290	61,673	62,035	62,386	62,727	63,070	
San Luis Obispo	16,545	16,652	16,957	17,151	17,343	17,533	17,721	17,907	18,085	18,263	18,442	
San Mateo	33,731	34,013	34,294	34,510	34,814	35,112	35,398	35,681	35,955	36,218	36,473	
Santa Barbara	26,514	26,820	27,149	27,149	27,527	27,899	28,278	28,656	29,020	29,396	29,768	
Santa Clara	96,435	98,057	98,583	99,174	99,966	100,728	101,489	102,244	102,956	103,657	104,344	
Santa Cruz	12,687	12,771	13,009	13,088	13,216	13,342	13,468	13,594	13,713	13,835	13,957	
Solano	26,676	26,859	27,041	27,141	27,361	27,582	27,803	28,023	28,235	28,432	28,645	
Sonoma	24,761	24,935	25,141	25,160	25,342	25,518	25,695	25,870	26,035	26,198	26,357	
Ventura	64,404	65,581	66,402	67,066	67,885	68,718	69,520	70,280	71,047	71,802	72,540	

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:											
	1/23	1/24	1/25	1/26	1/28			1/30			2/1					
Alameda	69,693	70,334	70,823	71,298	72,691	(14,538)	[3,489]	{1,745}	74,048	(14,810)	[3,554]	{1,777}	75,372	(15,074)	[3,618]	{1,809}
Contra Costa	54,416	54,951	55,245	55,593	56,408	(11,282)	[2,708]	{1,354}	57,200	(11,440)	[2,746]	{1,373}	57,938	(11,588)	[2,781]	{1,391}
Fresno	84,744	85,274	85,808	86,336	87,502	(17,500)	[4,200]	{2,100}	88,621	(17,724)	[4,254]	{2,127}	89,694	(17,939)	[4,305]	{2,153}
Kern	89,095	90,213	90,564	91,119	92,349	(18,470)	[4,433]	{2,216}	93,489	(18,698)	[4,487]	{2,244}	94,590	(18,918)	[4,540]	{2,270}
Lake	2,681	2,673	2,724	2,729	2,848	(570)	[137]	{68}	2,972	(594)	[143]	{71}	3,108	(622)	[149]	{75}
Los Angeles	1,065,505	1,073,156	1,079,672	1,085,488	1,101,230	(220,246)	[52,859]	{26,430}	1,116,199	(223,240)	[53,578]	{26,789}	1,129,936	(225,987)	[54,237]	{27,118}
Marin	11,930	11,954	12,024	12,067	12,193	(2,439)	[585]	{293}	12,310	(2,462)	[591]	{295}	12,419	(2,484)	[596]	{298}
Monterey	37,285	37,406	37,527	38,434	39,067	(7,813)	[1,875]	{938}	39,662	(7,932)	[1,904]	{952}	40,263	(8,053)	[1,933]	{966}
Orange	237,292	237,666	237,708	239,175	241,110	(48,222)	[11,573]	{5,787}	242,858	(48,572)	[11,657]	{5,829}	244,350	(48,870)	[11,729]	{5,864}
Placer	17,730	17,784	17,839	18,034	18,238	(3,648)	[875]	{438}	18,436	(3,687)	[885]	{442}	18,616	(3,723)	[894]	{447}
Riverside	260,476	262,419	264,363	266,849	272,002	(54,400)	[13,056]	{6,528}	277,163	(55,433)	[13,304]	{6,652}	282,243	(56,449)	[13,548]	{6,774}
Sacramento	82,861	83,408	84,110	84,653	85,963	(17,193)	[4,126]	{2,063}	87,181	(17,436)	[4,185]	{2,092}	88,375	(17,675)	[4,242]	{2,121}
San Bernardino	262,858	264,457	266,028	268,542	272,352	(54,470)	[13,073]	{6,536}	276,062	(55,212)	[13,251]	{6,625}	279,563	(55,913)	[13,419]	{6,710}
San Diego	225,558	227,195	228,632	230,066	233,850	(46,770)	[11,225]	{5,612}	237,378	(47,476)	[11,394]	{5,697}	240,733	(48,147)	[11,555]	{5,778}
San Francisco	30,027	30,308	30,559	30,734	31,154	(6,231)	[1,495]	{748}	31,553	(6,311)	[1,515]	{757}	31,933	(6,387)	[1,533]	{766}
San Joaquin	59,485	59,575	59,665	60,545	61,290	(12,258)	[2,942]	{1,471}	62,035	(12,407)	[2,978]	{1,489}	62,727	(12,545)	[3,011]	{1,505}
San Luis Obispo	16,545	16,652	16,957	17,151	17,533	(3,507)	[842]	{421}	17,907	(3,581)	[860]	{430}	18,263	(3,653)	[877]	{438}
San Mateo	33,731	34,013	34,294	34,510	35,112	(7,022)	[1,685]	{843}	35,681	(7,136)	[1,713]	{856}	36,218	(7,244)	[1,738]	{869}
Santa Barbara	26,514	26,820	27,149	27,149	27,899	(5,580)	[1,339]	{670}	28,656	(5,731)	[1,375]	{688}	29,396	(5,879)	[1,411]	{706}
Santa Clara	96,435	98,057	98,583	99,174	100,728	(20,146)	[4,835]	{2,417}	102,244	(20,449)	[4,908]	{2,454}	103,657	(20,731)	[4,976]	{2,488}
Santa Cruz	12,687	12,771	13,009	13,088	13,342	(2,668)	[640]	{320}	13,594	(2,719)	[653]	{326}	13,835	(2,767)	[664]	{332}
Solano	26,676	26,859	27,041	27,141	27,582	(5,516)	[1,324]	{662}	28,023	(5,605)	[1,345]	{673}	28,432	(5,686)	[1,365]	{682}
Sonoma	24,761	24,935	25,141	25,160	25,518	(5,104)	[1,225]	{612}	25,870	(5,174)	[1,242]	{621}	26,198	(5,240)	[1,258]	{629}
Ventura	64,404	65,581	66,402	67,066	68,718	(13,744)	[3,298]	{1,649}	70,280	(14,056)	[3,373]	{1,687}	71,802	(14,360)	[3,446]	{1,723}

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.