

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

Date: 2/1/21

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 2/1/21 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.**

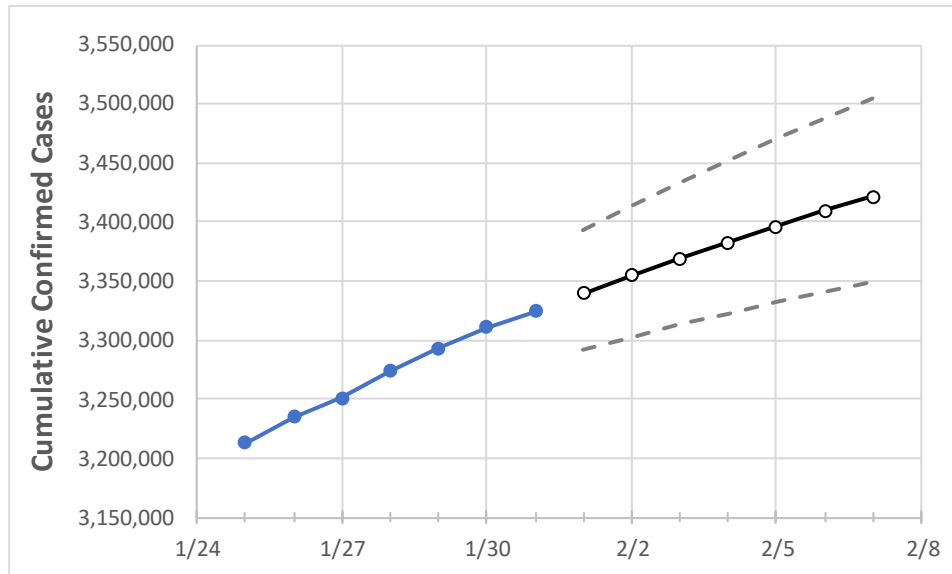
### IEM's Modeling Lead

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:						
	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7

California	3,273,905	3,293,531	3,310,949	3,324,264	3,339,653	3,354,975	3,369,394	3,383,046	3,396,058	3,409,342	3,421,330
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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:						
	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7
Alameda	72,597	73,115	73,542	73,771	74,185	74,624	75,039	75,418	75,819	76,188	76,509
Contra Costa	56,252	56,575	57,021	57,337	57,630	57,918	58,204	58,482	58,739	58,992	59,242
Fresno	86,886	87,401	87,936	88,476	88,864	89,234	89,591	89,926	90,248	90,575	90,887
Kern	92,327	92,992	93,628	94,113	94,627	95,124	95,606	96,081	96,557	97,011	97,452
Lake	2,750	2,772	2,792	2,809	2,824	2,837	2,850	2,862	2,874	2,885	2,896
Los Angeles	1,098,411	1,104,720	1,111,391	1,116,948	1,122,131	1,127,182	1,131,836	1,136,422	1,140,792	1,145,001	1,149,045
Marin	12,155	12,157	12,284	12,346	12,386	12,424	12,462	12,499	12,535	12,568	12,599
Monterey	38,853	39,040	39,425	39,425	39,693	39,973	40,239	40,493	40,760	41,019	41,253
Orange	241,648	243,212	244,562	245,978	246,665	247,315	247,971	248,595	249,206	249,773	250,295
Placer	18,267	18,399	18,415	18,430	18,498	18,564	18,625	18,686	18,741	18,793	18,846
Riverside	270,105	271,910	271,910	271,910	274,037	276,229	278,294	280,370	282,289	284,240	286,129
Sacramento	85,428	85,698	86,320	86,388	86,764	87,112	87,437	87,752	88,071	88,393	88,681
San Bernardino	271,189	272,198	273,520	274,429	275,541	276,633	277,687	278,714	279,726	280,629	281,525
San Diego	232,970	234,640	236,768	238,042	239,450	240,808	242,081	243,350	244,510	245,655	246,771
San Francisco	31,082	31,193	31,294	31,427	31,563	31,694	31,825	31,949	32,069	32,180	32,292
San Joaquin	61,548	61,901	61,901	61,901	62,241	62,583	62,922	63,259	63,625	63,961	64,278
San Luis Obispo	17,511	17,605	17,605	17,605	17,741	17,874	18,007	18,128	18,250	18,366	18,483
San Mateo	34,958	35,235	35,466	35,466	35,666	35,864	36,057	36,235	36,409	36,573	36,741
Santa Barbara	27,754	28,150	28,338	28,567	28,795	29,009	29,222	29,432	29,637	29,837	30,037
Santa Clara	100,468	100,997	101,453	101,964	102,440	102,911	103,327	103,727	104,129	104,505	104,864
Santa Cruz	13,235	13,321	13,352	13,383	13,445	13,507	13,566	13,621	13,673	13,723	13,773
Solano	27,486	27,706	27,706	27,706	27,881	28,052	28,220	28,381	28,551	28,712	28,875
Sonoma	25,678	25,825	25,992	26,108	26,253	26,390	26,523	26,654	26,776	26,899	27,018
Ventura	68,397	69,050	69,511	69,931	70,438	70,928	71,374	71,837	72,260	72,672	73,074

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:											
	1/28	1/29	1/30	1/31	2/2			2/4			2/6					
Alameda	72,597	73,115	73,542	73,771	74,624	(14,925)	[3,582]	{1,791}	75,418	(15,084)	[3,620]	{1,810}	76,188	(15,238)	[3,657]	{1,829}
Contra Costa	56,252	56,575	57,021	57,337	57,918	(11,584)	[2,780]	{1,390}	58,482	(11,696)	[2,807]	{1,404}	58,992	(11,798)	[2,832]	{1,416}
Fresno	86,886	87,401	87,936	88,476	89,234	(17,847)	[4,283]	{2,142}	89,926	(17,985)	[4,316]	{2,158}	90,575	(18,115)	[4,348]	{2,174}
Kern	92,327	92,992	93,628	94,113	95,124	(19,025)	[4,566]	{2,283}	96,081	(19,216)	[4,612]	{2,306}	97,011	(19,402)	[4,657]	{2,328}
Lake	2,750	2,772	2,792	2,809	2,837	(567)	[136]	{68}	2,862	(572)	[137]	{69}	2,885	(577)	[138]	{69}
Los Angeles	1,098,411	1,104,720	1,111,391	1,116,948	1,127,182	(225,436)	[54,105]	{27,052}	1,136,422	(227,284)	[54,548]	{27,274}	1,145,001	(229,000)	[54,960]	{27,480}
Marin	12,155	12,157	12,284	12,346	12,424	(2,485)	[596]	{298}	12,499	(2,500)	[600]	{300}	12,568	(2,514)	[603]	{302}
Monterey	38,853	39,040	39,425	39,425	39,973	(7,995)	[1,919]	{959}	40,493	(8,099)	[1,944]	{972}	41,019	(8,204)	[1,969]	{984}
Orange	241,648	243,212	244,562	245,978	247,315	(49,463)	[11,871]	{5,936}	248,595	(49,719)	[11,933]	{5,966}	249,773	(49,955)	[11,989]	{5,995}
Placer	18,267	18,399	18,415	18,430	18,564	(3,713)	[891]	{446}	18,686	(3,737)	[897]	{448}	18,793	(3,759)	[902]	{451}
Riverside	270,105	271,910	271,910	271,910	276,229	(55,246)	[13,259]	{6,630}	280,370	(56,074)	[13,458]	{6,729}	284,240	(56,848)	[13,644]	{6,822}
Sacramento	85,428	85,698	86,320	86,388	87,112	(17,422)	[4,181]	{2,091}	87,752	(17,550)	[4,212]	{2,106}	88,393	(17,679)	[4,243]	{2,121}
San Bernardino	271,189	272,198	273,520	274,429	276,633	(55,327)	[13,278]	{6,639}	278,714	(55,743)	[13,378]	{6,689}	280,629	(56,126)	[13,470]	{6,735}
San Diego	232,970	234,640	236,768	238,042	240,808	(48,162)	[11,559]	{5,779}	243,350	(48,670)	[11,681]	{5,840}	245,655	(49,131)	[11,791]	{5,896}
San Francisco	31,082	31,193	31,294	31,427	31,694	(6,339)	[1,521]	{761}	31,949	(6,390)	[1,534]	{767}	32,180	(6,436)	[1,545]	{772}
San Joaquin	61,548	61,901	61,901	61,901	62,583	(12,517)	[3,004]	{1,502}	63,259	(12,652)	[3,036]	{1,518}	63,961	(12,792)	[3,070]	{1,535}
San Luis Obispo	17,511	17,605	17,605	17,605	17,874	(3,575)	[858]	{429}	18,128	(3,626)	[870]	{435}	18,366	(3,673)	[882]	{441}
San Mateo	34,958	35,235	35,466	35,466	35,864	(7,173)	[1,721]	{861}	36,235	(7,247)	[1,739]	{870}	36,573	(7,315)	[1,756]	{878}
Santa Barbara	27,754	28,150	28,338	28,567	29,009	(5,802)	[1,392]	{696}	29,432	(5,886)	[1,413]	{706}	29,837	(5,967)	[1,432]	{716}
Santa Clara	100,468	100,997	101,453	101,964	102,911	(20,582)	[4,940]	{2,470}	103,727	(20,745)	[4,979]	{2,489}	104,505	(20,901)	[5,016]	{2,508}
Santa Cruz	13,235	13,321	13,352	13,383	13,507	(2,701)	[648]	{324}	13,621	(2,724)	[654]	{327}	13,723	(2,745)	[659]	{329}
Solano	27,486	27,706	27,706	27,706	28,052	(5,610)	[1,346]	{673}	28,381	(5,676)	[1,362]	{681}	28,712	(5,742)	[1,378]	{689}
Sonoma	25,678	25,825	25,992	26,108	26,390	(5,278)	[1,267]	{633}	26,654	(5,331)	[1,279]	{640}	26,899	(5,380)	[1,291]	{646}
Ventura	68,397	69,050	69,511	69,931	70,928	(14,186)	[3,405]	{1,702}	71,837	(14,367)	[3,448]	{1,724}	72,672	(14,534)	[3,488]	{1,744}

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.