

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

Date: 1/28/21

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 1/28/21 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.**

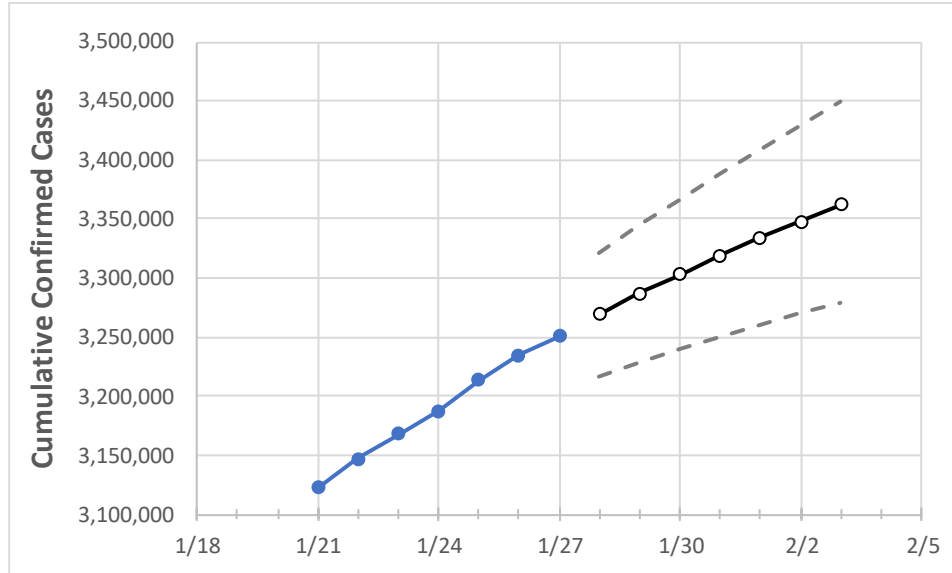
### IEM's Modeling Lead

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3

California 3,187,475 3,213,222 3,235,045 3,250,649 3,269,078 3,286,881 3,303,023 3,319,090 3,334,030 3,348,155 3,362,100

*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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Alameda	70,334	70,823	71,298	72,024	72,522	73,010	73,480	73,944	74,409	74,852	75,268
Contra Costa	54,951	55,245	55,593	55,593	55,910	56,196	56,463	56,724	56,972	57,219	57,450
Fresno	85,274	85,808	86,336	86,673	87,147	87,599	88,034	88,450	88,845	89,230	89,601
Kern	90,213	90,564	91,119	91,119	91,652	92,156	92,628	93,114	93,594	94,040	94,468
Lake	2,673	2,724	2,729	2,748	2,770	2,790	2,811	2,830	2,849	2,866	2,883
Los Angeles	1,073,156	1,079,672	1,085,488	1,091,712	1,097,793	1,103,725	1,109,254	1,114,560	1,119,678	1,124,431	1,129,069
Marin	11,954	12,024	12,067	12,067	12,110	12,151	12,190	12,227	12,262	12,294	12,326
Monterey	37,406	37,527	38,434	38,434	38,769	39,089	39,416	39,740	40,058	40,390	40,705
Orange	237,666	237,708	239,175	240,314	240,915	241,463	241,981	242,454	242,890	243,309	243,690
Placer	17,784	17,839	18,034	18,129	18,211	18,285	18,359	18,424	18,488	18,550	18,610
Riverside	262,419	264,363	266,849	268,490	270,860	273,211	275,460	277,718	279,853	282,139	284,234
Sacramento	83,408	84,110	84,653	85,062	85,541	86,001	86,446	86,880	87,295	87,687	88,066
San Bernardino	264,457	266,028	268,542	269,314	270,689	272,095	273,482	274,788	276,037	277,218	278,404
San Diego	227,195	228,632	230,066	231,481	233,059	234,565	236,030	237,381	238,678	239,973	241,191
San Francisco	30,308	30,559	30,734	30,874	31,048	31,217	31,378	31,529	31,673	31,809	31,954
San Joaquin	59,575	59,665	60,545	60,545	60,846	61,129	61,400	61,667	61,903	62,132	62,349
San Luis Obispo	16,652	16,957	17,151	17,151	17,295	17,439	17,577	17,705	17,835	17,957	18,082
San Mateo	34,013	34,294	34,510	34,738	34,990	35,229	35,459	35,686	35,898	36,101	36,300
Santa Barbara	26,820	27,149	27,235	27,321	27,556	27,785	28,005	28,215	28,417	28,617	28,807
Santa Clara	98,057	98,583	99,174	99,702	100,303	100,834	101,363	101,863	102,369	102,835	103,272
Santa Cruz	12,771	13,009	13,088	13,088	13,178	13,273	13,357	13,435	13,519	13,601	13,675
Solano	26,859	27,041	27,141	27,317	27,498	27,658	27,817	27,966	28,110	28,268	28,401
Sonoma	24,935	25,141	25,160	25,536	25,706	25,867	26,020	26,169	26,321	26,459	26,598
Ventura	65,581	66,402	67,066	67,526	68,123	68,686	69,231	69,753	70,249	70,734	71,207

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:											
	1/24	1/25	1/26	1/27	1/29				1/31				2/2			
Alameda	70,334	70,823	71,298	72,024	73,010	(14,602)	[3,504]	{1,752}	73,944	(14,789)	[3,549]	{1,775}	74,852	(14,970)	[3,593]	{1,796}
Contra Costa	54,951	55,245	55,593	55,593	56,196	(11,239)	[2,697]	{1,349}	56,724	(11,345)	[2,723]	{1,361}	57,219	(11,444)	[2,747]	{1,373}
Fresno	85,274	85,808	86,336	86,673	87,599	(17,520)	[4,205]	{2,102}	88,450	(17,690)	[4,246]	{2,123}	89,230	(17,846)	[4,283]	{2,142}
Kern	90,213	90,564	91,119	91,119	92,156	(18,431)	[4,423]	{2,212}	93,114	(18,623)	[4,469]	{2,235}	94,040	(18,808)	[4,514]	{2,257}
Lake	2,673	2,724	2,729	2,748	2,790	(558)	[134]	{67}	2,830	(566)	[136]	{68}	2,866	(573)	[138]	{69}
Los Angeles	1,073,156	1,079,672	1,085,488	1,091,712	1,103,725	(220,745)	[52,979]	{26,489}	1,114,560	(222,912)	[53,499]	{26,749}	1,124,431	(224,886)	[53,973]	{26,986}
Marin	11,954	12,024	12,067	12,067	12,151	(2,430)	[583]	{292}	12,227	(2,445)	[587]	{293}	12,294	(2,459)	[590]	{295}
Monterey	37,406	37,527	38,434	38,434	39,089	(7,818)	[1,876]	{938}	39,740	(7,948)	[1,908]	{954}	40,390	(8,078)	[1,939]	{969}
Orange	237,666	237,708	239,175	240,314	241,463	(48,293)	[11,590]	{5,795}	242,454	(48,491)	[11,638]	{5,819}	243,309	(48,662)	[11,679]	{5,839}
Placer	17,784	17,839	18,034	18,129	18,285	(3,657)	[878]	{439}	18,424	(3,685)	[884]	{442}	18,550	(3,710)	[890]	{445}
Riverside	262,419	264,363	266,849	268,490	273,211	(54,642)	[13,114]	{6,557}	277,718	(55,544)	[13,330]	{6,665}	282,139	(56,428)	[13,543]	{6,771}
Sacramento	83,408	84,110	84,653	85,062	86,001	(17,200)	[4,128]	{2,064}	86,880	(17,376)	[4,170]	{2,085}	87,687	(17,537)	[4,209]	{2,104}
San Bernardino	264,457	266,028	268,542	269,314	272,095	(54,419)	[13,061]	{6,530}	274,788	(54,958)	[13,190]	{6,595}	277,218	(55,444)	[13,306]	{6,653}
San Diego	227,195	228,632	230,066	231,481	234,565	(46,913)	[11,259]	{5,630}	237,381	(47,476)	[11,394]	{5,697}	239,973	(47,995)	[11,519]	{5,759}
San Francisco	30,308	30,559	30,734	30,874	31,217	(6,243)	[1,498]	{749}	31,529	(6,306)	[1,513]	{757}	31,809	(6,362)	[1,527]	{763}
San Joaquin	59,575	59,665	60,545	60,545	61,129	(12,226)	[2,934]	{1,467}	61,667	(12,333)	[2,960]	{1,480}	62,132	(12,426)	[2,982]	{1,491}
San Luis Obispo	16,652	16,957	17,151	17,151	17,439	(3,488)	[837]	{419}	17,705	(3,541)	[850]	{425}	17,957	(3,591)	[862]	{431}
San Mateo	34,013	34,294	34,510	34,738	35,229	(7,046)	[1,691]	{845}	35,686	(7,137)	[1,713]	{856}	36,101	(7,220)	[1,733]	{866}
Santa Barbara	26,820	27,149	27,235	27,321	27,785	(5,557)	[1,334]	{667}	28,215	(5,643)	[1,354]	{677}	28,617	(5,723)	[1,374]	{687}
Santa Clara	98,057	98,583	99,174	99,702	100,834	(20,167)	[4,840]	{2,420}	101,863	(20,373)	[4,889]	{2,445}	102,835	(20,567)	[4,936]	{2,468}
Santa Cruz	12,771	13,009	13,088	13,088	13,273	(2,655)	[637]	{319}	13,435	(2,687)	[645]	{322}	13,601	(2,720)	[653]	{326}
Solano	26,859	27,041	27,141	27,317	27,658	(5,532)	[1,328]	{664}	27,966	(5,593)	[1,342]	{671}	28,268	(5,654)	[1,357]	{678}
Sonoma	24,935	25,141	25,160	25,536	25,867	(5,173)	[1,242]	{621}	26,169	(5,234)	[1,256]	{628}	26,459	(5,292)	[1,270]	{635}
Ventura	65,581	66,402	67,066	67,526	68,686	(13,737)	[3,297]	{1,648}	69,753	(13,951)	[3,348]	{1,674}	70,734	(14,147)	[3,395]	{1,698}

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.