

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

Date: 2/11/21

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 2/11/21 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.**

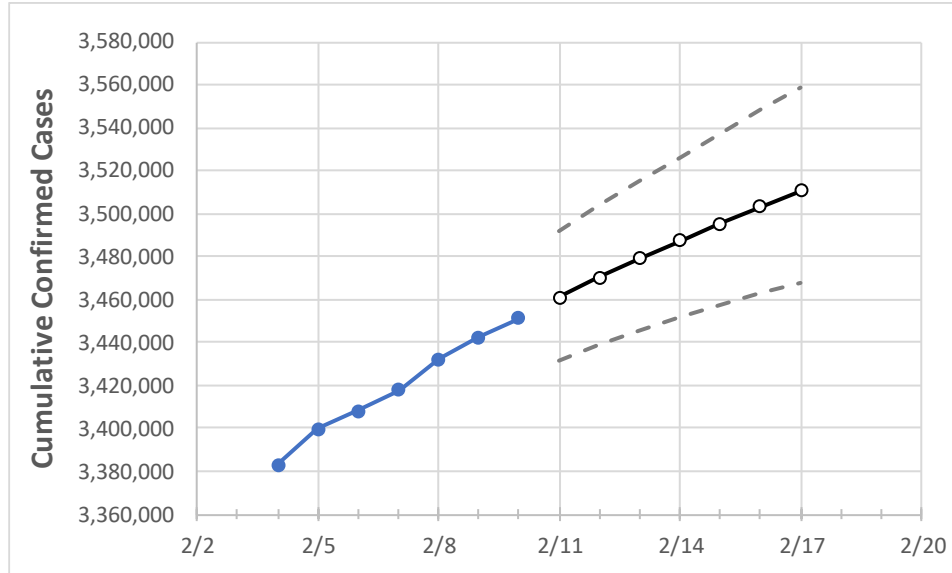
### IEM's Modeling Lead

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17

California 3,417,982 3,432,088 3,442,672 3,451,176 3,461,027 3,470,238 3,479,227 3,487,607 3,495,590 3,503,298 3,510,558

*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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Alameda	76,170	76,648	77,109	77,216	77,796	78,390	78,959	79,534	80,117	80,691	81,261
Contra Costa	59,107	59,313	59,585	59,751	59,958	60,159	60,357	60,541	60,722	60,893	61,055
Fresno	90,944	91,184	91,430	91,730	91,989	92,233	92,471	92,688	92,905	93,120	93,323
Kern	97,249	97,522	98,187	98,636	99,029	99,415	99,781	100,149	100,516	100,859	101,194
Lake	2,920	2,940	2,949	2,955	2,966	2,977	2,988	2,999	3,009	3,018	3,028
Los Angeles	1,146,483	1,149,346	1,152,430	1,155,491	1,158,393	1,161,028	1,163,540	1,165,982	1,168,257	1,170,435	1,172,499
Marin	12,625	12,657	12,678	12,715	12,748	12,778	12,808	12,836	12,864	12,891	12,917
Monterey	40,657	40,783	40,908	40,971	41,081	41,186	41,285	41,378	41,465	41,548	41,627
Orange	252,311	253,289	253,900	254,417	255,235	256,011	256,773	257,513	258,246	258,970	259,665
Placer	18,836	18,973	19,036	19,121	19,171	19,219	19,266	19,310	19,354	19,396	19,438
Riverside	281,881	282,736	283,525	284,168	284,876	285,584	286,240	286,862	287,446	287,992	288,543
Sacramento	88,532	88,919	89,267	89,378	89,593	89,795	89,991	90,176	90,351	90,516	90,677
San Bernardino	278,376	278,802	279,412	279,673	280,081	280,431	280,778	281,097	281,382	281,627	281,899
San Diego	246,564	247,462	248,051	248,861	249,726	250,569	251,370	252,153	252,905	253,624	254,311
San Francisco	32,437	32,609	32,679	32,782	32,885	32,979	33,074	33,165	33,253	33,339	33,421
San Joaquin	63,965	64,138	64,396	64,457	64,638	64,816	64,995	65,165	65,336	65,494	65,646
San Luis Obispo	18,612	18,684	18,788	18,838	18,917	18,994	19,068	19,138	19,206	19,271	19,333
San Mateo	36,824	37,058	37,139	37,277	37,401	37,520	37,633	37,741	37,842	37,941	38,034
Santa Barbara	29,941	30,087	30,206	30,352	30,493	30,632	30,776	30,910	31,037	31,157	31,281
Santa Clara	105,094	105,386	105,740	106,023	106,340	106,647	106,936	107,204	107,473	107,729	107,969
Santa Cruz	13,963	14,011	14,055	14,092	14,139	14,183	14,227	14,272	14,315	14,356	14,396
Solano	28,891	28,994	29,040	29,172	29,264	29,354	29,445	29,528	29,612	29,693	29,768
Sonoma	26,836	26,909	26,939	26,971	27,035	27,101	27,163	27,224	27,282	27,335	27,391
Ventura	73,431	73,759	74,068	74,333	74,672	75,011	75,324	75,620	75,907	76,179	76,445

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:											
	2/7	2/8	2/9	2/10	2/12				2/14				2/16			
Alameda	76,170	76,648	77,109	77,216	78,390	(15,678)	[3,763]	{1,881}	79,534	(15,907)	[3,818]	{1,909}	80,691	(16,138)	[3,873]	{1,937}
Contra Costa	59,107	59,313	59,585	59,751	60,159	(12,032)	[2,888]	{1,444}	60,541	(12,108)	[2,906]	{1,453}	60,893	(12,179)	[2,923]	{1,461}
Fresno	90,944	91,184	91,430	91,730	92,233	(18,447)	[4,427]	{2,214}	92,688	(18,538)	[4,449]	{2,225}	93,120	(18,624)	[4,470]	{2,235}
Kern	97,249	97,522	98,187	98,636	99,415	(19,883)	[4,772]	{2,386}	100,149	(20,030)	[4,807]	{2,404}	100,859	(20,172)	[4,841]	{2,421}
Lake	2,920	2,940	2,949	2,955	2,977	(595)	[143]	{71}	2,999	(600)	[144]	{72}	3,018	(604)	[145]	{72}
Los Angeles	1,146,483	1,149,346	1,152,430	1,155,491	1,161,028	(232,206)	[55,729]	{27,865}	1,165,982	(233,196)	[55,967]	{27,984}	1,170,435	(234,087)	[56,181]	{28,090}
Marin	12,625	12,657	12,678	12,715	12,778	(2,556)	[613]	{307}	12,836	(2,567)	[616]	{308}	12,891	(2,578)	[619]	{309}
Monterey	40,657	40,783	40,908	40,971	41,186	(8,237)	[1,977]	{988}	41,378	(8,276)	[1,986]	{993}	41,548	(8,310)	[1,994]	{997}
Orange	252,311	253,289	253,900	254,417	256,011	(51,202)	[12,289]	{6,144}	257,513	(51,503)	[12,361]	{6,180}	258,970	(51,794)	[12,431]	{6,215}
Placer	18,836	18,973	19,036	19,121	19,219	(3,844)	[923]	{461}	19,310	(3,862)	[927]	{463}	19,396	(3,879)	[931]	{466}
Riverside	281,881	282,736	283,525	284,168	285,584	(57,117)	[13,708]	{6,854}	286,862	(57,372)	[13,769]	{6,885}	287,992	(57,598)	[13,824]	{6,912}
Sacramento	88,532	88,919	89,267	89,378	89,795	(17,959)	[4,310]	{2,155}	90,176	(18,035)	[4,328]	{2,164}	90,516	(18,103)	[4,345]	{2,172}
San Bernardino	278,376	278,802	279,412	279,673	280,431	(56,086)	[13,461]	{6,730}	281,097	(56,219)	[13,493]	{6,746}	281,627	(56,325)	[13,518]	{6,759}
San Diego	246,564	247,462	248,051	248,861	250,569	(50,114)	[12,027]	{6,014}	252,153	(50,431)	[12,103]	{6,052}	253,624	(50,725)	[12,174]	{6,087}
San Francisco	32,437	32,609	32,679	32,782	32,979	(6,596)	[1,583]	{791}	33,165	(6,633)	[1,592]	{796}	33,339	(6,668)	[1,600]	{800}
San Joaquin	63,965	64,138	64,396	64,457	64,816	(12,963)	[3,111]	{1,556}	65,165	(13,033)	[3,128]	{1,564}	65,494	(13,099)	[3,144]	{1,572}
San Luis Obispo	18,612	18,684	18,788	18,838	18,994	(3,799)	[912]	{456}	19,138	(3,828)	[919]	{459}	19,271	(3,854)	[925]	{462}
San Mateo	36,824	37,058	37,139	37,277	37,520	(7,504)	[1,801]	{900}	37,741	(7,548)	[1,812]	{906}	37,941	(7,588)	[1,821]	{911}
Santa Barbara	29,941	30,087	30,206	30,352	30,632	(6,126)	[1,470]	{735}	30,910	(6,182)	[1,484]	{742}	31,157	(6,231)	[1,496]	{748}
Santa Clara	105,094	105,386	105,740	106,023	106,647	(21,329)	[5,119]	{2,560}	107,204	(21,441)	[5,146]	{2,573}	107,729	(21,546)	[5,171]	{2,585}
Santa Cruz	13,963	14,011	14,055	14,092	14,183	(2,837)	[681]	{340}	14,272	(2,854)	[685]	{343}	14,356	(2,871)	[689]	{345}
Solano	28,891	28,994	29,040	29,172	29,354	(5,871)	[1,409]	{704}	29,528	(5,906)	[1,417]	{709}	29,693	(5,939)	[1,425]	{713}
Sonoma	26,836	26,909	26,939	26,971	27,101	(5,420)	[1,301]	{650}	27,224	(5,445)	[1,307]	{653}	27,335	(5,467)	[1,312]	{656}
Ventura	73,431	73,759	74,068	74,333	75,011	(15,002)	[3,601]	{1,800}	75,620	(15,124)	[3,630]	{1,815}	76,179	(15,236)	[3,657]	{1,828}

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.