

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 2/10/21**

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 2/10/21 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.**

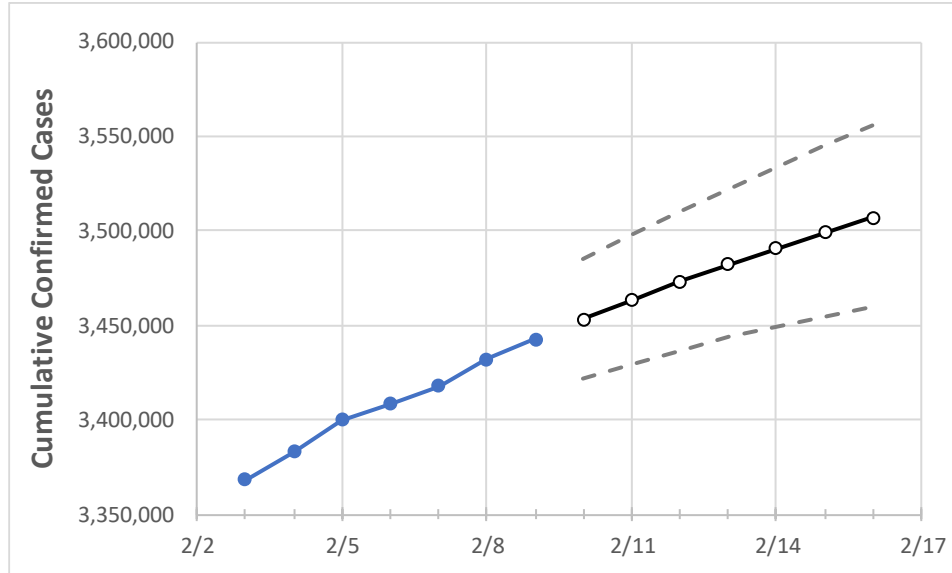
**IEM's Modeling Lead**

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:							
	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	
California	3,408,241	3,417,982	3,432,088	3,442,672	3,453,251	3,463,282	3,473,040	3,482,123	3,490,813	3,498,989	3,507,080	

*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:						
	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16
Alameda	75,737	76,170	76,648	77,109	77,808	78,517	79,227	79,930	80,660	81,376	82,121
Contra Costa	58,839	59,107	59,313	59,585	59,805	60,016	60,228	60,431	60,627	60,816	61,000
Fresno	90,513	90,944	91,184	91,430	91,689	91,944	92,189	92,419	92,644	92,862	93,057
Kern	96,862	97,249	97,522	98,187	98,587	98,972	99,352	99,725	100,080	100,420	100,757
Lake	2,906	2,920	2,940	2,949	2,961	2,974	2,986	2,997	3,008	3,019	3,029
Los Angeles	1,143,591	1,146,483	1,149,346	1,152,430	1,155,474	1,158,347	1,161,036	1,163,579	1,165,946	1,168,182	1,170,360
Marin	12,603	12,625	12,657	12,678	12,709	12,739	12,767	12,795	12,823	12,849	12,874
Monterey	40,532	40,657	40,783	40,908	41,044	41,185	41,316	41,444	41,565	41,688	41,801
Orange	251,079	252,311	253,289	253,900	254,780	255,632	256,462	257,287	258,117	258,903	259,694
Placer	18,810	18,836	18,973	19,036	19,086	19,132	19,178	19,222	19,265	19,305	19,344
Riverside	281,025	281,881	282,736	283,525	284,306	285,063	285,769	286,423	287,063	287,663	288,222
Sacramento	87,992	88,532	88,919	89,267	89,485	89,700	89,893	90,069	90,237	90,404	90,559
San Bernardino	277,949	278,376	278,802	279,412	279,859	280,264	280,618	280,943	281,263	281,572	281,831
San Diego	245,334	246,564	247,462	248,051	248,976	249,871	250,724	251,548	252,327	253,076	253,786
San Francisco	32,229	32,437	32,609	32,679	32,781	32,881	32,975	33,069	33,162	33,246	33,327
San Joaquin	63,792	63,965	64,138	64,396	64,601	64,806	65,013	65,209	65,394	65,588	65,774
San Luis Obispo	18,539	18,612	18,684	18,788	18,879	18,963	19,045	19,125	19,203	19,277	19,349
San Mateo	36,689	36,824	37,058	37,139	37,270	37,393	37,510	37,619	37,730	37,833	37,932
Santa Barbara	29,755	29,941	30,087	30,206	30,359	30,504	30,636	30,769	30,899	31,016	31,138
Santa Clara	104,609	105,094	105,386	105,740	106,082	106,416	106,730	107,036	107,326	107,606	107,873
Santa Cruz	13,915	13,963	14,011	14,055	14,107	14,158	14,205	14,252	14,297	14,342	14,385
Solano	28,789	28,891	28,994	29,040	29,135	29,228	29,316	29,401	29,486	29,560	29,630
Sonoma	26,674	26,836	26,909	26,939	27,022	27,101	27,174	27,244	27,309	27,374	27,435
Ventura	72,953	73,431	73,759	74,068	74,435	74,778	75,119	75,426	75,735	76,034	76,325

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:											
	2/6	2/7	2/8	2/9	2/11				2/13				2/15			
Alameda	75,737	76,170	76,648	77,109	78,517	(15,703)	[3,769]	{1,884}	79,930	(15,986)	[3,837]	{1,918}	81,376	(16,275)	[3,906]	{1,953}
Contra Costa	58,839	59,107	59,313	59,585	60,016	(12,003)	[2,881]	{1,440}	60,431	(12,086)	[2,901]	{1,450}	60,816	(12,163)	[2,919]	{1,460}
Fresno	90,513	90,944	91,184	91,430	91,944	(18,389)	[4,413]	{2,207}	92,419	(18,484)	[4,436]	{2,218}	92,862	(18,572)	[4,457]	{2,229}
Kern	96,862	97,249	97,522	98,187	98,972	(19,794)	[4,751]	{2,375}	99,725	(19,945)	[4,787]	{2,393}	100,420	(20,084)	[4,820]	{2,410}
Lake	2,906	2,920	2,940	2,949	2,974	(595)	[143]	{71}	2,997	(599)	[144]	{72}	3,019	(604)	[145]	{72}
Los Angeles	1,143,591	1,146,483	1,149,346	1,152,430	1,158,347	(231,669)	[55,601]	{27,800}	1,163,579	(232,716)	[55,852]	{27,926}	1,168,182	(233,636)	[56,073]	{28,036}
Marin	12,603	12,625	12,657	12,678	12,739	(2,548)	[611]	{306}	12,795	(2,559)	[614]	{307}	12,849	(2,570)	[617]	{308}
Monterey	40,532	40,657	40,783	40,908	41,185	(8,237)	[1,977]	{988}	41,444	(8,289)	[1,989]	{995}	41,688	(8,338)	[2,001]	{1,001}
Orange	251,079	252,311	253,289	253,900	255,632	(51,126)	[12,270]	{6,135}	257,287	(51,457)	[12,350]	{6,175}	258,903	(51,781)	[12,427]	{6,214}
Placer	18,810	18,836	18,973	19,036	19,132	(3,826)	[918]	{459}	19,222	(3,844)	[923]	{461}	19,305	(3,861)	[927]	{463}
Riverside	281,025	281,881	282,736	283,525	285,063	(57,013)	[13,683]	{6,842}	286,423	(57,285)	[13,748]	{6,874}	287,663	(57,533)	[13,808]	{6,904}
Sacramento	87,992	88,532	88,919	89,267	89,700	(17,940)	[4,306]	{2,153}	90,069	(18,014)	[4,323]	{2,162}	90,404	(18,081)	[4,339]	{2,170}
San Bernardino	277,949	278,376	278,802	279,412	280,264	(56,053)	[13,453]	{6,726}	280,943	(56,189)	[13,485]	{6,743}	281,572	(56,314)	[13,515]	{6,758}
San Diego	245,334	246,564	247,462	248,051	249,871	(49,974)	[11,994]	{5,997}	251,548	(50,310)	[12,074]	{6,037}	253,076	(50,615)	[12,148]	{6,074}
San Francisco	32,229	32,437	32,609	32,679	32,881	(6,576)	[1,578]	{789}	33,069	(6,614)	[1,587]	{794}	33,246	(6,649)	[1,596]	{798}
San Joaquin	63,792	63,965	64,138	64,396	64,806	(12,961)	[3,111]	{1,555}	65,209	(13,042)	[3,130]	{1,565}	65,588	(13,118)	[3,148]	{1,574}
San Luis Obispo	18,539	18,612	18,684	18,788	18,963	(3,793)	[910]	{455}	19,125	(3,825)	[918]	{459}	19,277	(3,855)	[925]	{463}
San Mateo	36,689	36,824	37,058	37,139	37,393	(7,479)	[1,795]	{897}	37,619	(7,524)	[1,806]	{903}	37,833	(7,567)	[1,816]	{908}
Santa Barbara	29,755	29,941	30,087	30,206	30,504	(6,101)	[1,464]	{732}	30,769	(6,154)	[1,477]	{738}	31,016	(6,203)	[1,489]	{744}
Santa Clara	104,609	105,094	105,386	105,740	106,416	(21,283)	[5,108]	{2,554}	107,036	(21,407)	[5,138]	{2,569}	107,606	(21,521)	[5,165]	{2,583}
Santa Cruz	13,915	13,963	14,011	14,055	14,158	(2,832)	[680]	{340}	14,252	(2,850)	[684]	{342}	14,342	(2,868)	[688]	{344}
Solano	28,789	28,891	28,994	29,040	29,228	(5,846)	[1,403]	{701}	29,401	(5,880)	[1,411]	{706}	29,560	(5,912)	[1,419]	{709}
Sonoma	26,674	26,836	26,909	26,939	27,101	(5,420)	[1,301]	{650}	27,244	(5,449)	[1,308]	{654}	27,374	(5,475)	[1,314]	{657}
Ventura	72,953	73,431	73,759	74,068	74,778	(14,956)	[3,589]	{1,795}	75,426	(15,085)	[3,620]	{1,810}	76,034	(15,207)	[3,650]	{1,825}

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.