

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

Date: 2/2/21

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 2/2/21 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.

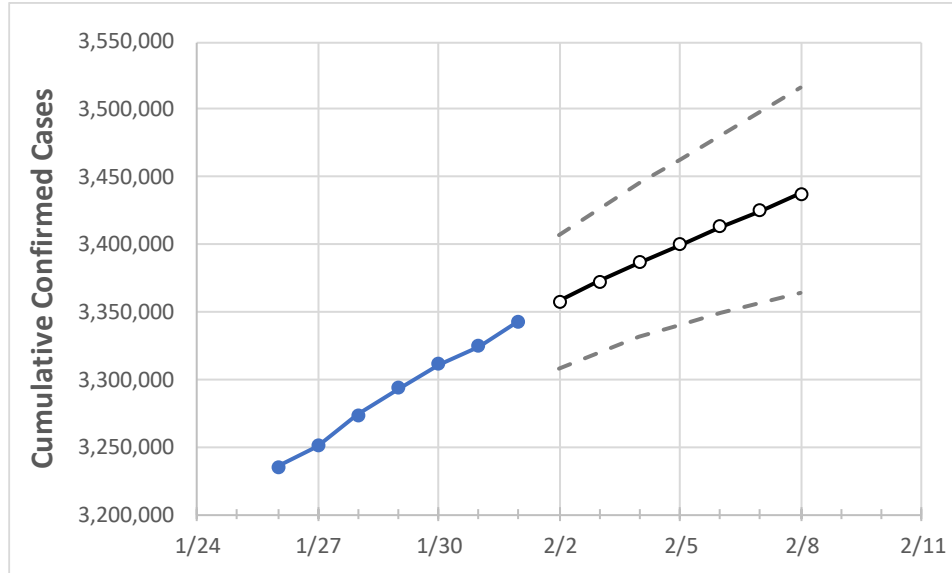
IEM's Modeling Lead

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:						
	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8

California 3,293,531 3,310,949 3,324,264 3,342,647 3,357,980 3,372,424 3,386,553 3,400,049 3,413,004 3,425,312 3,437,564

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:							
	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	
Alameda	73,115	73,542	73,771	74,087	74,447	74,798	75,134	75,464	75,776	76,061	76,340	
Contra Costa	56,575	57,021	57,337	57,580	57,857	58,137	58,387	58,628	58,866	59,087	59,313	
Fresno	87,401	87,936	88,476	88,852	89,222	89,578	89,932	90,272	90,586	90,901	91,199	
Kern	92,992	93,628	94,113	94,467	94,938	95,394	95,847	96,291	96,715	97,117	97,517	
Lake	2,772	2,792	2,809	2,826	2,841	2,854	2,867	2,879	2,891	2,902	2,912	
Los Angeles	1,104,720	1,111,391	1,116,948	1,121,107	1,126,014	1,130,601	1,134,898	1,139,097	1,143,234	1,147,143	1,150,824	
Marin	12,157	12,284	12,346	12,372	12,410	12,447	12,482	12,514	12,548	12,577	12,609	
Monterey	39,040	39,425	39,425	39,425	39,707	39,980	40,252	40,521	40,775	41,040	41,307	
Orange	243,212	244,562	245,978	247,035	247,758	248,439	249,079	249,721	250,337	250,930	251,477	
Placer	18,399	18,415	18,430	18,608	18,681	18,750	18,817	18,882	18,944	19,003	19,057	
Riverside	271,910	273,231	274,551	275,872	277,508	279,134	280,686	282,134	283,655	285,166	286,564	
Sacramento	85,698	86,320	86,388	86,560	86,885	87,193	87,483	87,765	88,032	88,271	88,525	
San Bernardino	272,198	273,520	274,429	275,076	276,101	277,104	278,059	278,984	279,839	280,667	281,491	
San Diego	234,640	236,768	238,042	239,142	240,437	241,686	242,864	244,050	245,134	246,203	247,220	
San Francisco	31,193	31,294	31,427	31,563	31,696	31,823	31,945	32,064	32,182	32,292	32,395	
San Joaquin	61,901	61,983	62,064	62,146	62,388	62,622	62,856	63,067	63,288	63,494	63,698	
San Luis Obispo	17,605	17,699	17,793	17,887	18,004	18,115	18,224	18,330	18,428	18,525	18,616	
San Mateo	35,235	35,466	35,674	35,882	36,080	36,265	36,445	36,616	36,784	36,942	37,099	
Santa Barbara	28,150	28,338	28,567	28,830	29,058	29,275	29,492	29,701	29,899	30,094	30,292	
Santa Clara	100,997	101,453	101,964	102,427	102,871	103,296	103,703	104,077	104,436	104,794	105,144	
Santa Cruz	13,321	13,352	13,383	13,606	13,683	13,755	13,826	13,894	13,960	14,026	14,088	
Solano	27,706	27,868	28,029	28,191	28,346	28,499	28,647	28,788	28,931	29,069	29,197	
Sonoma	25,825	25,992	26,108	26,189	26,314	26,439	26,555	26,670	26,774	26,885	26,996	
Ventura	69,050	69,511	69,931	70,799	71,318	71,822	72,313	72,785	73,237	73,683	74,114	

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:											
	1/29	1/30	1/31	2/1	2/3			2/5			2/7					
Alameda	73,115	73,542	73,771	74,087	74,798	(14,960)	[3,590]	{1,795}	75,464	(15,093)	[3,622]	{1,811}	76,061	(15,212)	[3,651]	{1,825}
Contra Costa	56,575	57,021	57,337	57,580	58,137	(11,627)	[2,791]	{1,395}	58,628	(11,726)	[2,814]	{1,407}	59,087	(11,817)	[2,836]	{1,418}
Fresno	87,401	87,936	88,476	88,852	89,578	(17,916)	[4,300]	{2,150}	90,272	(18,054)	[4,333]	{2,167}	90,901	(18,180)	[4,363]	{2,182}
Kern	92,992	93,628	94,113	94,467	95,394	(19,079)	[4,579]	{2,289}	96,291	(19,258)	[4,622]	{2,311}	97,117	(19,423)	[4,662]	{2,331}
Lake	2,772	2,792	2,809	2,826	2,854	(571)	[137]	{68}	2,879	(576)	[138]	{69}	2,902	(580)	[139]	{70}
Los Angeles	1,104,720	1,111,391	1,116,948	1,121,107	1,130,601	(226,120)	[54,269]	{27,134}	1,139,097	(227,819)	[54,677]	{27,338}	1,147,143	(229,429)	[55,063]	{27,531}
Marin	12,157	12,284	12,346	12,372	12,447	(2,489)	[597]	{299}	12,514	(2,503)	[601]	{300}	12,577	(2,515)	[604]	{302}
Monterey	39,040	39,425	39,425	39,425	39,980	(7,996)	[1,919]	{960}	40,521	(8,104)	[1,945]	{973}	41,040	(8,208)	[1,970]	{985}
Orange	243,212	244,562	245,978	247,035	248,439	(49,688)	[11,925]	{5,963}	249,721	(49,944)	[11,987]	{5,993}	250,930	(50,186)	[12,045]	{6,022}
Placer	18,399	18,415	18,430	18,608	18,750	(3,750)	[900]	{450}	18,882	(3,776)	[906]	{453}	19,003	(3,801)	[912]	{456}
Riverside	271,910	273,231	274,551	275,872	279,134	(55,827)	[13,398]	{6,699}	282,134	(56,427)	[13,542]	{6,771}	285,166	(57,033)	[13,688]	{6,844}
Sacramento	85,698	86,320	86,388	86,560	87,193	(17,439)	[4,185]	{2,093}	87,765	(17,553)	[4,213]	{2,106}	88,271	(17,654)	[4,237]	{2,118}
San Bernardino	272,198	273,520	274,429	275,076	277,104	(55,421)	[13,301]	{6,650}	278,984	(55,797)	[13,391]	{6,696}	280,667	(56,133)	[13,472]	{6,736}
San Diego	234,640	236,768	238,042	239,142	241,686	(48,337)	[11,601]	{5,800}	244,050	(48,810)	[11,714]	{5,857}	246,203	(49,241)	[11,818]	{5,909}
San Francisco	31,193	31,294	31,427	31,563	31,823	(6,365)	[1,528]	{764}	32,064	(6,413)	[1,539]	{770}	32,292	(6,458)	[1,550]	{775}
San Joaquin	61,901	61,983	62,064	62,146	62,622	(12,524)	[3,006]	{1,503}	63,067	(12,613)	[3,027]	{1,514}	63,494	(12,699)	[3,048]	{1,524}
San Luis Obispo	17,605	17,699	17,793	17,887	18,115	(3,623)	[870]	{435}	18,330	(3,666)	[880]	{440}	18,525	(3,705)	[889]	{445}
San Mateo	35,235	35,466	35,674	35,882	36,265	(7,253)	[1,741]	{870}	36,616	(7,323)	[1,758]	{879}	36,942	(7,388)	[1,773]	{887}
Santa Barbara	28,150	28,338	28,567	28,830	29,275	(5,855)	[1,405]	{703}	29,701	(5,940)	[1,426]	{713}	30,094	(6,019)	[1,444]	{722}
Santa Clara	100,997	101,453	101,964	102,427	103,296	(20,659)	[4,958]	{2,479}	104,077	(20,815)	[4,996]	{2,498}	104,794	(20,959)	[5,030]	{2,515}
Santa Cruz	13,321	13,352	13,383	13,606	13,755	(2,751)	[660]	{330}	13,894	(2,779)	[667]	{333}	14,026	(2,805)	[673]	{337}
Solano	27,706	27,868	28,029	28,191	28,499	(5,700)	[1,368]	{684}	28,788	(5,758)	[1,382]	{691}	29,069	(5,814)	[1,395]	{698}
Sonoma	25,825	25,992	26,108	26,189	26,439	(5,288)	[1,269]	{635}	26,670	(5,334)	[1,280]	{640}	26,885	(5,377)	[1,290]	{645}
Ventura	69,050	69,511	69,931	70,799	71,822	(14,364)	[3,447]	{1,724}	72,785	(14,557)	[3,494]	{1,747}	73,683	(14,737)	[3,537]	{1,768}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.