

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 1/26/21**

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 1/26/21 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.

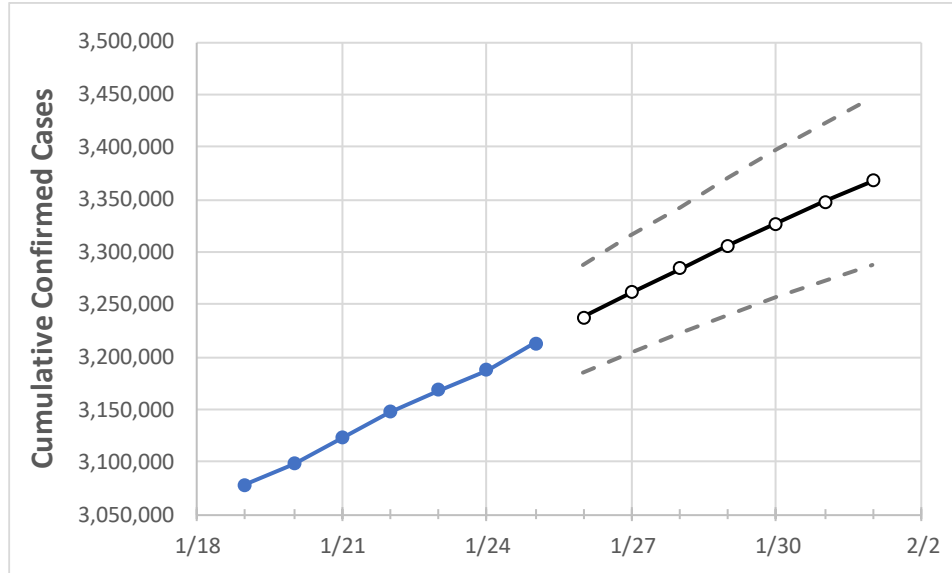
IEM's Modeling Lead

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:						
	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	
California	3,147,207	3,168,028	3,187,475	3,213,222	3,237,614	3,261,484	3,284,003	3,305,853	3,327,052	3,347,480	3,367,377	

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:						
	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1
Alameda	69,554	69,693	70,334	70,823	71,548	72,267	72,961	73,664	74,358	75,045	75,703
Contra Costa	54,140	54,416	54,951	55,245	55,687	56,118	56,555	56,983	57,393	57,798	58,194
Fresno	84,137	84,744	85,274	85,808	86,428	87,029	87,617	88,213	88,784	89,347	89,891
Kern	88,399	89,095	90,213	90,564	91,216	91,863	92,486	93,098	93,688	94,300	94,893
Lake	2,669	2,681	2,673	2,724	2,781	2,838	2,896	2,954	3,012	3,071	3,132
Los Angeles	1,054,802	1,065,505	1,073,156	1,079,672	1,088,519	1,097,253	1,105,658	1,114,116	1,122,133	1,130,013	1,137,666
Marin	11,899	11,930	11,954	12,024	12,092	12,157	12,223	12,285	12,347	12,408	12,467
Monterey	36,950	37,285	37,406	37,527	37,776	38,006	38,220	38,430	38,622	38,807	38,981
Orange	237,198	237,292	237,666	237,708	238,735	239,667	240,571	241,447	242,270	243,047	243,801
Placer	17,675	17,730	17,784	17,839	17,946	18,046	18,140	18,238	18,335	18,427	18,508
Riverside	258,532	260,476	262,419	264,363	267,301	270,143	272,911	275,633	278,325	281,115	283,855
Sacramento	82,303	82,861	83,408	84,110	84,764	85,402	86,046	86,664	87,267	87,905	88,489
San Bernardino	261,199	262,858	264,457	266,028	267,988	269,975	271,925	273,760	275,622	277,536	279,332
San Diego	222,578	225,558	227,195	228,632	230,754	232,765	234,692	236,594	238,436	240,220	241,946
San Francisco	29,801	30,027	30,308	30,559	30,783	31,006	31,226	31,439	31,655	31,863	32,070
San Joaquin	59,395	59,485	59,575	59,665	60,045	60,426	60,814	61,187	61,562	61,935	62,300
San Luis Obispo	16,437	16,545	16,652	16,957	17,156	17,350	17,538	17,726	17,910	18,088	18,266
San Mateo	33,468	33,731	34,013	34,294	34,621	34,940	35,259	35,568	35,876	36,170	36,458
Santa Barbara	25,986	26,514	26,820	27,149	27,543	27,943	28,341	28,727	29,112	29,509	29,903
Santa Clara	96,340	96,435	98,057	98,583	99,451	100,289	101,105	101,905	102,700	103,490	104,257
Santa Cruz	12,649	12,687	12,771	13,009	13,143	13,273	13,400	13,526	13,656	13,789	13,917
Solano	26,494	26,676	26,859	27,041	27,269	27,506	27,732	27,972	28,197	28,421	28,657
Sonoma	24,571	24,761	24,935	25,141	25,360	25,573	25,787	26,000	26,213	26,422	26,630
Ventura	63,995	64,404	65,581	66,402	67,298	68,169	69,021	69,873	70,713	71,537	72,356

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:											
	1/22	1/23	1/24	1/25	1/27				1/29				1/31			
Alameda	69,554	69,693	70,334	70,823	72,267	(14,453)	[3,469]	{1,734}	73,664	(14,733)	[3,536]	{1,768}	75,045	(15,009)	[3,602]	{1,801}
Contra Costa	54,140	54,416	54,951	55,245	56,118	(11,224)	[2,694]	{1,347}	56,983	(11,397)	[2,735]	{1,368}	57,798	(11,560)	[2,774]	{1,387}
Fresno	84,137	84,744	85,274	85,808	87,029	(17,406)	[4,177]	{2,089}	88,213	(17,643)	[4,234]	{2,117}	89,347	(17,869)	[4,289]	{2,144}
Kern	88,399	89,095	90,213	90,564	91,863	(18,373)	[4,409]	{2,205}	93,098	(18,620)	[4,469]	{2,234}	94,300	(18,860)	[4,526]	{2,263}
Lake	2,669	2,681	2,673	2,724	2,838	(568)	[136]	{68}	2,954	(591)	[142]	{71}	3,071	(614)	[147]	{74}
Los Angeles	1,054,802	1,065,505	1,073,156	1,079,672	1,097,253	(219,451)	[52,668]	{26,334}	1,114,116	(222,823)	[53,478]	{26,739}	1,130,013	(226,003)	[54,241]	{27,120}
Marin	11,899	11,930	11,954	12,024	12,157	(2,431)	[584]	{292}	12,285	(2,457)	[590]	{295}	12,408	(2,482)	[596]	{298}
Monterey	36,950	37,285	37,406	37,527	38,006	(7,601)	[1,824]	{912}	38,430	(7,686)	[1,845]	{922}	38,807	(7,761)	[1,863]	{931}
Orange	237,198	237,292	237,666	237,708	239,667	(47,933)	[11,504]	{5,752}	241,447	(48,289)	[11,589]	{5,795}	243,047	(48,609)	[11,666]	{5,833}
Placer	17,675	17,730	17,784	17,839	18,046	(3,609)	[866]	{433}	18,238	(3,648)	[875]	{438}	18,427	(3,685)	[884]	{442}
Riverside	258,532	260,476	262,419	264,363	270,143	(54,029)	[12,967]	{6,483}	275,633	(55,127)	[13,230]	{6,615}	281,115	(56,223)	[13,494]	{6,747}
Sacramento	82,303	82,861	83,408	84,110	85,402	(17,080)	[4,099]	{2,050}	86,664	(17,333)	[4,160]	{2,080}	87,905	(17,581)	[4,219]	{2,110}
San Bernardino	261,199	262,858	264,457	266,028	269,975	(53,995)	[12,959]	{6,479}	273,760	(54,752)	[13,140]	{6,570}	277,536	(55,507)	[13,322]	{6,661}
San Diego	222,578	225,558	227,195	228,632	232,765	(46,553)	[11,173]	{5,586}	236,594	(47,319)	[11,357]	{5,678}	240,220	(48,044)	[11,531]	{5,765}
San Francisco	29,801	30,027	30,308	30,559	31,006	(6,201)	[1,488]	{744}	31,439	(6,288)	[1,509]	{755}	31,863	(6,373)	[1,529]	{765}
San Joaquin	59,395	59,485	59,575	59,665	60,426	(12,085)	[2,900]	{1,450}	61,187	(12,237)	[2,937]	{1,468}	61,935	(12,387)	[2,973]	{1,486}
San Luis Obispo	16,437	16,545	16,652	16,957	17,350	(3,470)	[833]	{416}	17,726	(3,545)	[851]	{425}	18,088	(3,618)	[868]	{434}
San Mateo	33,468	33,731	34,013	34,294	34,940	(6,988)	[1,677]	{839}	35,568	(7,114)	[1,707]	{854}	36,170	(7,234)	[1,736]	{868}
Santa Barbara	25,986	26,514	26,820	27,149	27,943	(5,589)	[1,341]	{671}	28,727	(5,745)	[1,379]	{689}	29,509	(5,902)	[1,416]	{708}
Santa Clara	96,340	96,435	98,057	98,583	100,289	(20,058)	[4,814]	{2,407}	101,905	(20,381)	[4,891]	{2,446}	103,490	(20,698)	[4,968]	{2,484}
Santa Cruz	12,649	12,687	12,771	13,009	13,273	(2,655)	[637]	{319}	13,526	(2,705)	[649]	{325}	13,789	(2,758)	[662]	{331}
Solano	26,494	26,676	26,859	27,041	27,506	(5,501)	[1,320]	{660}	27,972	(5,594)	[1,343]	{671}	28,421	(5,684)	[1,364]	{682}
Sonoma	24,571	24,761	24,935	25,141	25,573	(5,115)	[1,227]	{614}	26,000	(5,200)	[1,248]	{624}	26,422	(5,284)	[1,268]	{634}
Ventura	63,995	64,404	65,581	66,402	68,169	(13,634)	[3,272]	{1,636}	69,873	(13,975)	[3,354]	{1,677}	71,537	(14,307)	[3,434]	{1,717}

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.