

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

Date: 1/5/21

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 1/5/21 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.**

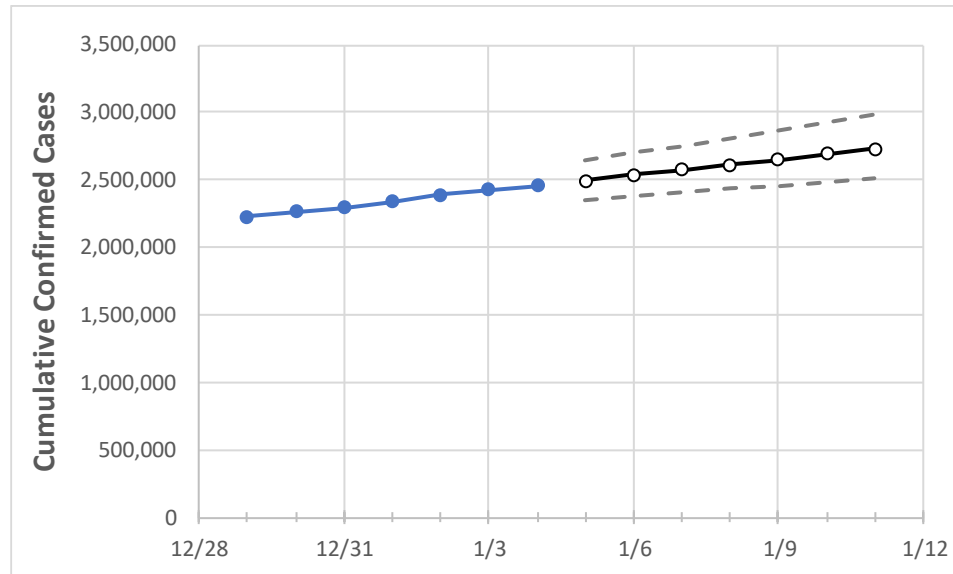
### IEM's Modeling Lead

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:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
California	2,336,201	2,388,557	2,426,930	2,458,100	2,496,711	2,535,773	2,574,603	2,613,811	2,652,026	2,691,123	2,730,251

*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:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
Alameda	52,475	53,518	54,518	55,073	55,845	56,630	57,421	58,212	58,998	59,798	60,584
Contra Costa	40,697	41,599	41,993	42,628	43,243	43,842	44,445	45,074	45,718	46,345	47,006
Fresno	66,442	67,484	68,740	69,318	70,148	70,955	71,817	72,628	73,417	74,225	75,004
Kern	68,969	69,484	70,358	71,033	71,882	72,763	73,651	74,521	75,388	76,226	77,059
Lake	1,848	1,888	1,925	1,976	2,013	2,054	2,093	2,134	2,175	2,217	2,259
Los Angeles	790,582	806,210	818,639	827,498	840,981	854,746	868,243	881,883	895,637	909,446	923,961
Marin	9,798	9,900	10,012	10,119	10,206	10,297	10,387	10,480	10,573	10,669	10,766
Monterey	27,859	28,465	28,991	29,352	29,813	30,268	30,722	31,191	31,652	32,132	32,604
Orange	161,586	165,440	168,457	170,579	173,681	176,855	180,010	183,130	186,358	189,533	192,905
Placer	13,871	13,987	14,182	14,687	14,912	15,128	15,348	15,578	15,810	16,031	16,252
Riverside	184,193	188,674	192,069	198,236	201,855	205,571	209,274	213,099	217,040	220,963	224,993
Sacramento	65,817	66,956	67,810	68,551	69,397	70,244	71,090	71,923	72,750	73,567	74,386
San Bernardino	199,115	203,651	206,939	208,271	211,265	214,221	217,116	219,977	222,922	225,813	228,669
San Diego	160,048	164,500	168,020	171,033	174,463	177,926	181,423	185,039	188,683	192,396	196,150
San Francisco	23,740	24,145	24,414	24,588	24,865	25,138	25,419	25,696	25,976	26,252	26,539
San Joaquin	45,764	46,640	47,310	47,886	48,573	49,258	49,940	50,644	51,345	52,022	52,716
San Luis Obispo	10,846	11,160	11,467	11,635	11,861	12,094	12,329	12,580	12,838	13,105	13,376
San Mateo	24,815	25,041	25,483	25,767	26,087	26,401	26,710	27,026	27,341	27,654	27,969
Santa Barbara	17,434	17,759	18,135	18,265	18,549	18,847	19,142	19,448	19,761	20,075	20,405
Santa Clara	71,755	73,493	74,359	74,527	75,718	76,892	78,058	79,221	80,386	81,599	82,841
Santa Cruz	8,909	9,146	9,340	9,526	9,722	9,922	10,127	10,338	10,550	10,773	10,994
Solano	19,302	19,393	19,805	20,953	21,401	21,859	22,349	22,866	23,383	23,924	24,458
Sonoma	19,129	19,513	19,761	19,980	20,210	20,438	20,676	20,909	21,153	21,387	21,633
Ventura	40,854	42,026	43,397	43,747	44,819	45,939	47,076	48,241	49,449	50,670	51,941

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:											
	1/1	1/2	1/3	1/4	1/6				1/8				1/10			
Alameda	52,475	53,518	54,518	55,073	56,630	(11,326)	[2,718]	{1,359}	58,212	(11,642)	[2,794]	{1,397}	59,798	(11,960)	[2,870]	{1,435}
Contra Costa	40,697	41,599	41,993	42,628	43,842	(8,768)	[2,104]	{1,052}	45,074	(9,015)	[2,164]	{1,082}	46,345	(9,269)	[2,225]	{1,112}
Fresno	66,442	67,484	68,740	69,318	70,955	(14,191)	[3,406]	{1,703}	72,628	(14,526)	[3,486]	{1,743}	74,225	(14,845)	[3,563]	{1,781}
Kern	68,969	69,484	70,358	71,033	72,763	(14,553)	[3,493]	{1,746}	74,521	(14,904)	[3,577]	{1,789}	76,226	(15,245)	[3,659]	{1,829}
Lake	1,848	1,888	1,925	1,976	2,054	(411)	[99]	{49}	2,134	(427)	[102]	{51}	2,217	(443)	[106]	{53}
Los Angeles	790,582	806,210	818,639	827,498	854,746	(170,949)	[41,028]	{20,514}	881,883	(176,377)	[42,330]	{21,165}	909,446	(181,889)	[43,653]	{21,827}
Marin	9,798	9,900	10,012	10,119	10,297	(2,059)	[494]	{247}	10,480	(2,096)	[503]	{252}	10,669	(2,134)	[512]	{256}
Monterey	27,859	28,465	28,991	29,352	30,268	(6,054)	[1,453]	{726}	31,191	(6,238)	[1,497]	{749}	32,132	(6,426)	[1,542]	{771}
Orange	161,586	165,440	168,457	170,579	176,855	(35,371)	[8,489]	{4,245}	183,130	(36,626)	[8,790]	{4,395}	189,533	(37,907)	[9,098]	{4,549}
Placer	13,871	13,987	14,182	14,687	15,128	(3,026)	[726]	{363}	15,578	(3,116)	[748]	{374}	16,031	(3,206)	[770]	{385}
Riverside	184,193	188,674	192,069	198,236	205,571	(41,114)	[9,867]	{4,934}	213,099	(42,620)	[10,229]	{5,114}	220,963	(44,193)	[10,606]	{5,303}
Sacramento	65,817	66,956	67,810	68,551	70,244	(14,049)	[3,372]	{1,686}	71,923	(14,385)	[3,452]	{1,726}	73,567	(14,713)	[3,531]	{1,766}
San Bernardino	199,115	203,651	206,939	208,271	214,221	(42,844)	[10,283]	{5,141}	219,977	(43,995)	[10,559]	{5,279}	225,813	(45,163)	[10,839]	{5,420}
San Diego	160,048	164,500	168,020	171,033	177,926	(35,585)	[8,540]	{4,270}	185,039	(37,008)	[8,882]	{4,441}	192,396	(38,479)	[9,235]	{4,618}
San Francisco	23,740	24,145	24,414	24,588	25,138	(5,028)	[1,207]	{603}	25,696	(5,139)	[1,233]	{617}	26,252	(5,250)	[1,260]	{630}
San Joaquin	45,764	46,640	47,310	47,886	49,258	(9,852)	[2,364]	{1,182}	50,644	(10,129)	[2,431]	{1,215}	52,022	(10,404)	[2,497]	{1,249}
San Luis Obispo	10,846	11,160	11,467	11,635	12,094	(2,419)	[581]	{290}	12,580	(2,516)	[604]	{302}	13,105	(2,621)	[629]	{315}
San Mateo	24,815	25,041	25,483	25,767	26,401	(5,280)	[1,267]	{634}	27,026	(5,405)	[1,297]	{649}	27,654	(5,531)	[1,327]	{664}
Santa Barbara	17,434	17,759	18,135	18,265	18,847	(3,769)	[905]	{452}	19,448	(3,890)	[934]	{467}	20,075	(4,015)	[964]	{482}
Santa Clara	71,755	73,493	74,359	74,527	76,892	(15,378)	[3,691]	{1,845}	79,221	(15,844)	[3,803]	{1,901}	81,599	(16,320)	[3,917]	{1,958}
Santa Cruz	8,909	9,146	9,340	9,526	9,922	(1,984)	[476]	{238}	10,338	(2,068)	[496]	{248}	10,773	(2,155)	[517]	{259}
Solano	19,302	19,393	19,805	20,953	21,859	(4,372)	[1,049]	{525}	22,866	(4,573)	[1,098]	{549}	23,924	(4,785)	[1,148]	{574}
Sonoma	19,129	19,513	19,761	19,980	20,438	(4,088)	[981]	{491}	20,909	(4,182)	[1,004]	{502}	21,387	(4,277)	[1,027]	{513}
Ventura	40,854	42,026	43,397	43,747	45,939	(9,188)	[2,205]	{1,103}	48,241	(9,648)	[2,316]	{1,158}	50,670	(10,134)	[2,432]	{1,216}

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.