

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

Date: 11/24/20

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 11/24/20 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.**

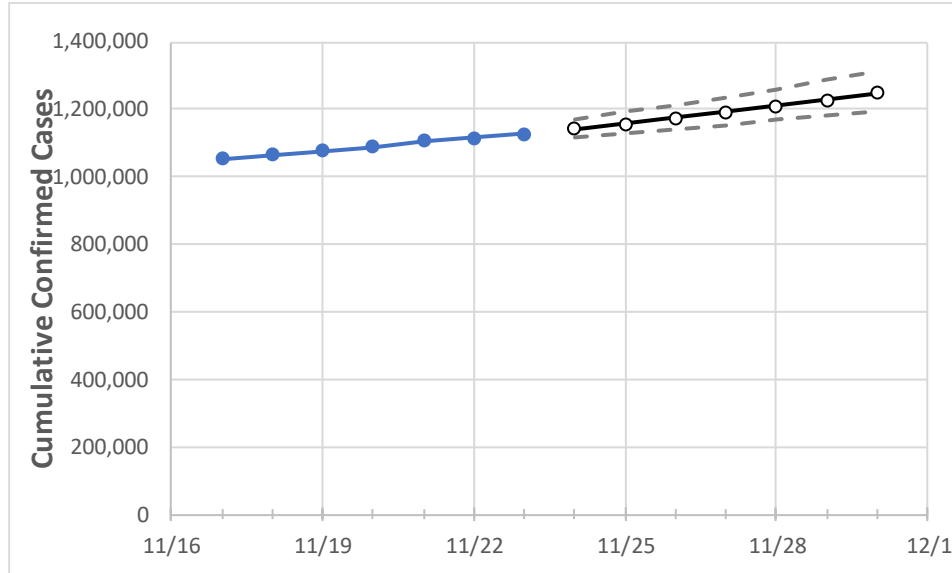
### IEM's Modeling Lead

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:					
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
California	1,089,750	1,105,435	1,114,524	1,128,219	1,142,867	1,158,281	1,174,500	1,191,565	1,209,518	1,228,404	1,248,270

*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 20%, and are often within 10%, of actual confirmed cases.*

**California Counties**

	Actual Confirmed Cases On:				Projected Cases For:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Alameda	27,223	27,435	27,485	27,622	27,824	28,033	28,249	28,471	28,701	28,938	29,182
Contra Costa	21,959	22,191	22,412	22,482	22,698	22,922	23,154	23,395	23,644	23,903	24,171
Fresno	35,278	35,635	35,973	36,315	36,688	37,082	37,496	37,933	38,394	38,879	39,390
Kern	37,632	37,982	38,316	38,519	38,844	39,188	39,553	39,940	40,351	40,786	41,247
Los Angeles	357,451	361,869	364,520	370,636	375,104	379,797	384,723	389,897	395,328	401,029	407,014
Marin	7,489	7,506	7,518	7,560	7,587	7,615	7,644	7,675	7,707	7,740	7,775
Monterey	13,410	13,738	13,886	13,887	13,966	14,046	14,128	14,211	14,295	14,381	14,468
Orange	68,336	69,142	69,694	71,116	71,958	72,852	73,803	74,814	75,887	77,028	78,240
Placer	5,687	5,733	5,778	6,071	6,168	6,271	6,378	6,492	6,611	6,737	6,870
Riverside	78,535	79,613	80,676	81,565	82,506	83,497	84,542	85,642	86,802	88,023	89,310
Sacramento	32,411	32,865	33,133	33,421	33,928	34,458	35,010	35,587	36,189	36,818	37,473
San Bernardino	81,328	84,201	84,531	85,176	86,320	87,527	88,799	90,140	91,553	93,043	94,613
San Diego	69,231	70,709	71,648	72,815	74,003	75,283	76,661	78,144	79,740	81,457	83,306
San Francisco	14,251	14,327	14,445	14,542	14,675	14,812	14,955	15,102	15,256	15,414	15,579
San Joaquin	24,450	24,649	24,649	24,649	24,761	24,879	25,004	25,137	25,277	25,425	25,582
San Luis Obispo	5,486	5,607	5,618	5,664	5,747	5,834	5,926	6,022	6,122	6,227	6,338
San Mateo	12,988	13,203	13,269	13,334	13,451	13,572	13,697	13,826	13,961	14,100	14,244
Santa Barbara	10,768	10,839	10,922	10,946	11,012	11,081	11,154	11,229	11,308	11,391	11,477
Santa Clara	30,025	30,411	30,676	31,103	31,531	31,979	32,449	32,942	33,457	33,997	34,563
Santa Cruz	3,685	3,819	3,898	3,896	3,958	4,023	4,094	4,169	4,250	4,336	4,429
Solano	9,349	9,354	9,358	9,363	9,390	9,416	9,440	9,464	9,487	9,508	9,529
Sonoma	11,340	11,363	11,428	11,486	11,535	11,584	11,632	11,680	11,727	11,774	11,820
Ventura	17,300	17,741	18,040	18,105	18,338	18,585	18,845	19,121	19,412	19,719	20,044

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:											
	11/20	11/21	11/22	11/23	11/25		11/27		11/29							
Alameda	27,223	27,435	27,485	27,622	28,033	(5,607)	[1,346]	{673}	28,471	(5,694)	[1,367]	{683}	28,938	(5,788)	[1,389]	{695}
Contra Costa	21,959	22,191	22,412	22,482	22,922	(4,584)	[1,100]	{550}	23,395	(4,679)	[1,123]	{561}	23,903	(4,781)	[1,147]	{574}
Fresno	35,278	35,635	35,973	36,315	37,082	(7,416)	[1,780]	{890}	37,933	(7,587)	[1,821]	{910}	38,879	(7,776)	[1,866]	{933}
Kern	37,632	37,982	38,316	38,519	39,188	(7,838)	[1,881]	{941}	39,940	(7,988)	[1,917]	{959}	40,786	(8,157)	[1,958]	{979}
Los Angeles	357,451	361,869	364,520	370,636	379,797	(75,959)	[18,230]	{9,115}	389,897	(77,979)	[18,715]	{9,358}	401,029	(80,206)	[19,249]	{9,625}
Marin	7,489	7,506	7,518	7,560	7,615	(1,523)	[366]	{183}	7,675	(1,535)	[368]	{184}	7,740	(1,548)	[372]	{186}
Monterey	13,410	13,738	13,886	13,887	14,046	(2,809)	[674]	{337}	14,211	(2,842)	[682]	{341}	14,381	(2,876)	[690]	{345}
Orange	68,336	69,142	69,694	71,116	72,852	(14,570)	[3,497]	{1,748}	74,814	(14,963)	[3,591]	{1,796}	77,028	(15,406)	[3,697]	{1,849}
Placer	5,687	5,733	5,778	6,071	6,271	(1,254)	[301]	{150}	6,492	(1,298)	[312]	{156}	6,737	(1,347)	[323]	{162}
Riverside	78,535	79,613	80,676	81,565	83,497	(16,699)	[4,008]	{2,004}	85,642	(17,128)	[4,111]	{2,055}	88,023	(17,605)	[4,225]	{2,113}
Sacramento	32,411	32,865	33,133	33,421	34,458	(6,892)	[1,654]	{827}	35,587	(7,117)	[1,708]	{854}	36,818	(7,364)	[1,767]	{884}
San Bernardino	81,328	84,201	84,531	85,176	87,527	(17,505)	[4,201]	{2,101}	90,140	(18,028)	[4,327]	{2,163}	93,043	(18,609)	[4,466]	{2,233}
San Diego	69,231	70,709	71,648	72,815	75,283	(15,057)	[3,614]	{1,807}	78,144	(15,629)	[3,751]	{1,875}	81,457	(16,291)	[3,910]	{1,955}
San Francisco	14,251	14,327	14,445	14,542	14,812	(2,962)	[711]	{355}	15,102	(3,020)	[725]	{362}	15,414	(3,083)	[740]	{370}
San Joaquin	24,450	24,649	24,649	24,649	24,879	(4,976)	[1,194]	{597}	25,137	(5,027)	[1,207]	{603}	25,425	(5,085)	[1,220]	{610}
San Luis Obispo	5,486	5,607	5,618	5,664	5,834	(1,167)	[280]	{140}	6,022	(1,204)	[289]	{145}	6,227	(1,245)	[299]	{149}
San Mateo	12,988	13,203	13,269	13,334	13,572	(2,714)	[651]	{326}	13,826	(2,765)	[664]	{332}	14,100	(2,820)	[677]	{338}
Santa Barbara	10,768	10,839	10,922	10,946	11,081	(2,216)	[532]	{266}	11,229	(2,246)	[539]	{270}	11,391	(2,278)	[547]	{273}
Santa Clara	30,025	30,411	30,676	31,103	31,979	(6,396)	[1,535]	{768}	32,942	(6,588)	[1,581]	{791}	33,997	(6,799)	[1,632]	{816}
Santa Cruz	3,685	3,819	3,898	3,896	4,023	(805)	[193]	{97}	4,169	(834)	[200]	{100}	4,336	(867)	[208]	{104}
Solano	9,349	9,354	9,358	9,363	9,416	(1,883)	[452]	{226}	9,464	(1,893)	[454]	{227}	9,508	(1,902)	[456]	{228}
Sonoma	11,340	11,363	11,428	11,486	11,584	(2,317)	[556]	{278}	11,680	(2,336)	[561]	{280}	11,774	(2,355)	[565]	{283}
Ventura	17,300	17,741	18,040	18,105	18,585	(3,717)	[892]	{446}	19,121	(3,824)	[918]	{459}	19,719	(3,944)	[947]	{473}

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.