

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 12/15/21**

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 12/15/21 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.**

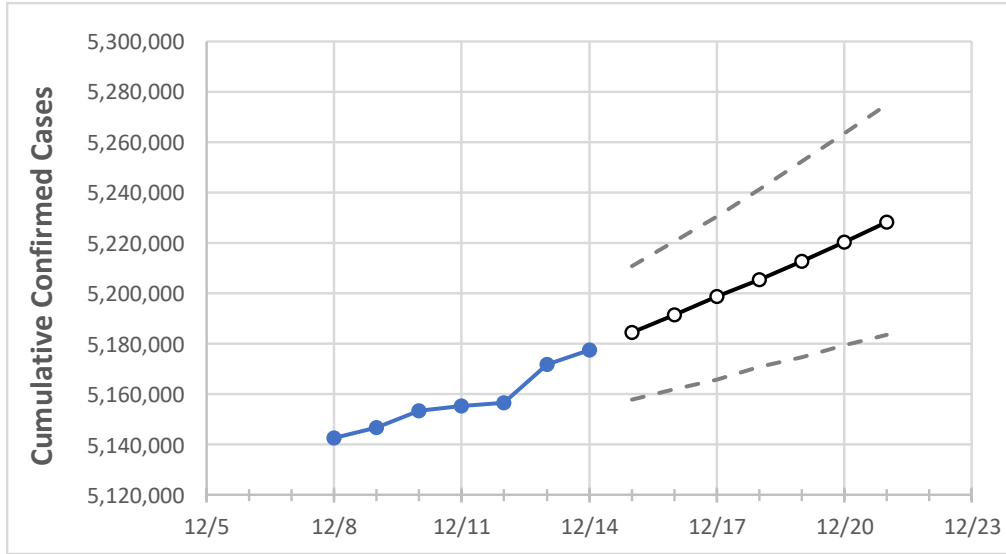
**IEM's Modeling Lead**

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:						
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
California	5,155,233	5,156,692	5,171,651	5,177,395	5,184,462	5,191,434	5,198,636	5,205,302	5,212,860	5,220,355	5,228,095

*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:						
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
Alameda	126,909	127,076	127,244	127,343	127,499	127,651	127,813	127,970	128,149	128,310	128,471
Contra Costa	105,193	105,313	105,432	105,497	105,607	105,720	105,822	105,939	106,042	106,169	106,277
Fresno	158,979	159,155	159,332	159,455	159,608	159,750	159,911	160,072	160,217	160,380	160,547
Kern	159,880	160,040	160,199	160,477	160,684	160,883	161,090	161,292	161,498	161,703	161,903
Lake	7,098	7,105	7,113	7,116	7,120	7,123	7,127	7,130	7,133	7,136	7,140
Los Angeles	1,545,583	1,547,042	1,548,157	1,549,296	1,551,039	1,552,876	1,554,645	1,556,470	1,558,372	1,560,353	1,562,264
Marin	18,932	18,970	19,007	19,027	19,065	19,101	19,139	19,177	19,219	19,260	19,301
Monterey	53,389	53,451	53,512	53,542	53,598	53,655	53,712	53,766	53,824	53,883	53,940
Orange	338,327	338,716	339,106	339,305	339,709	340,116	340,528	340,953	341,374	341,813	342,272
Placer	43,062	43,122	43,182	43,211	43,271	43,328	43,387	43,443	43,508	43,569	43,617
Riverside	393,801	394,407	395,013	395,274	395,832	396,295	396,854	397,387	397,929	398,494	399,035
Sacramento	171,091	171,344	171,598	171,746	171,989	172,223	172,456	172,685	172,936	173,186	173,437
San Bernardino	380,996	381,606	382,217	382,514	383,081	383,602	384,111	384,670	385,222	385,759	386,292
San Diego	415,350	415,695	416,039	417,998	418,972	419,947	420,953	421,954	423,007	424,151	425,260
San Francisco	57,874	57,977	58,081	58,146	58,237	58,328	58,416	58,515	58,609	58,712	58,811
San Joaquin	109,007	109,137	109,268	109,312	109,411	109,512	109,616	109,712	109,812	109,924	110,030
San Luis Obispo	31,991	32,041	32,092	32,119	32,156	32,198	32,236	32,277	32,314	32,363	32,400
San Mateo	57,266	57,339	57,413	57,477	57,549	57,618	57,684	57,763	57,835	57,908	57,988
Santa Barbara	48,182	48,275	48,367	48,389	48,464	48,542	48,616	48,691	48,769	48,851	48,924
Santa Clara	154,738	154,940	155,142	155,362	155,579	155,785	155,987	156,210	156,406	156,635	156,847
Santa Cruz	22,722	22,760	22,798	22,825	22,862	22,898	22,931	22,967	23,000	23,041	23,076
Solano	48,254	48,298	48,341	48,365	48,411	48,457	48,503	48,551	48,593	48,645	48,691
Sonoma	43,877	43,942	44,008	44,076	44,138	44,202	44,265	44,333	44,392	44,464	44,526
Ventura	105,442	105,574	105,705	105,780	105,916	106,030	106,143	106,269	106,414	106,553	106,676

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:											
	12/11	12/12	12/13	12/14	12/16				12/18				12/20			
Alameda	126,909	127,076	127,244	127,343	127,651	(25,530)	[6,127]	{3,064}	127,970	(25,594)	[6,143]	{3,071}	128,310	(25,662)	[6,159]	{3,079}
Contra Costa	105,193	105,313	105,432	105,497	105,720	(21,144)	[5,075]	{2,537}	105,939	(21,188)	[5,085]	{2,543}	106,169	(21,234)	[5,096]	{2,548}
Fresno	158,979	159,155	159,332	159,455	159,750	(31,950)	[7,668]	{3,834}	160,072	(32,014)	[7,683]	{3,842}	160,380	(32,076)	[7,698]	{3,849}
Kern	159,880	160,040	160,199	160,477	160,883	(32,177)	[7,722]	{3,861}	161,292	(32,258)	[7,742]	{3,871}	161,703	(32,341)	[7,762]	{3,881}
Lake	7,098	7,105	7,113	7,116	7,123	(1,425)	[342]	{171}	7,130	(1,426)	[342]	{171}	7,136	(1,427)	[343]	{171}
Los Angeles	1,545,583	1,547,042	1,548,157	1,549,296	1,552,876	(310,575)	[74,538]	{37,269}	1,556,470	(311,294)	[74,711]	{37,355}	1,560,353	(312,071)	[74,897]	{37,448}
Marin	18,932	18,970	19,007	19,027	19,101	(3,820)	[917]	{458}	19,177	(3,835)	[921]	{460}	19,260	(3,852)	[924]	{462}
Monterey	53,389	53,451	53,512	53,542	53,655	(10,731)	[2,575]	{1,288}	53,766	(10,753)	[2,581]	{1,290}	53,883	(10,777)	[2,586]	{1,293}
Orange	338,327	338,716	339,106	339,305	340,116	(68,023)	[16,326]	{8,163}	340,953	(68,191)	[16,366]	{8,183}	341,813	(68,363)	[16,407]	{8,204}
Placer	43,062	43,122	43,182	43,211	43,328	(8,666)	[2,080]	{1,040}	43,443	(8,689)	[2,085]	{1,043}	43,569	(8,714)	[2,091]	{1,046}
Riverside	393,801	394,407	395,013	395,274	396,295	(79,259)	[19,022]	{9,511}	397,387	(79,477)	[19,075]	{9,537}	398,494	(79,699)	[19,128]	{9,564}
Sacramento	171,091	171,344	171,598	171,746	172,223	(34,445)	[8,267]	{4,133}	172,685	(34,537)	[8,289]	{4,144}	173,186	(34,637)	[8,313]	{4,156}
San Bernardino	380,996	381,606	382,217	382,514	383,602	(76,720)	[18,413]	{9,206}	384,670	(76,934)	[18,464]	{9,232}	385,759	(77,152)	[18,516]	{9,258}
San Diego	415,350	415,695	416,039	417,998	419,947	(83,989)	[20,157]	{10,079}	421,954	(84,391)	[20,254]	{10,127}	424,151	(84,830)	[20,359]	{10,180}
San Francisco	57,874	57,977	58,081	58,146	58,328	(11,666)	[2,800]	{1,400}	58,515	(11,703)	[2,809]	{1,404}	58,712	(11,742)	[2,818]	{1,409}
San Joaquin	109,007	109,137	109,268	109,312	109,512	(21,902)	[5,257]	{2,628}	109,712	(21,942)	[5,266]	{2,633}	109,924	(21,985)	[5,276]	{2,638}
San Luis Obispo	31,991	32,041	32,092	32,119	32,198	(6,440)	[1,545]	{773}	32,277	(6,455)	[1,549]	{775}	32,363	(6,473)	[1,553]	{777}
San Mateo	57,266	57,339	57,413	57,477	57,618	(11,524)	[2,766]	{1,383}	57,763	(11,553)	[2,773]	{1,386}	57,908	(11,582)	[2,780]	{1,390}
Santa Barbara	48,182	48,275	48,367	48,389	48,542	(9,708)	[2,330]	{1,165}	48,691	(9,738)	[2,337]	{1,169}	48,851	(9,770)	[2,345]	{1,172}
Santa Clara	154,738	154,940	155,142	155,362	155,785	(31,157)	[7,478]	{3,739}	156,210	(31,242)	[7,498]	{3,749}	156,635	(31,327)	[7,518]	{3,759}
Santa Cruz	22,722	22,760	22,798	22,825	22,898	(4,580)	[1,099]	{550}	22,967	(4,593)	[1,102]	{551}	23,041	(4,608)	[1,106]	{553}
Solano	48,254	48,298	48,341	48,365	48,457	(9,691)	[2,326]	{1,163}	48,551	(9,710)	[2,330]	{1,165}	48,645	(9,729)	[2,335]	{1,167}
Sonoma	43,877	43,942	44,008	44,076	44,202	(8,840)	[2,122]	{1,061}	44,333	(8,867)	[2,128]	{1,064}	44,464	(8,893)	[2,134]	{1,067}
Ventura	105,442	105,574	105,705	105,780	106,030	(21,206)	[5,089]	{2,545}	106,269	(21,254)	[5,101]	{2,550}	106,553	(21,311)	[5,115]	{2,557}

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.