

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 3/17/21**

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 3/17/21 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.**

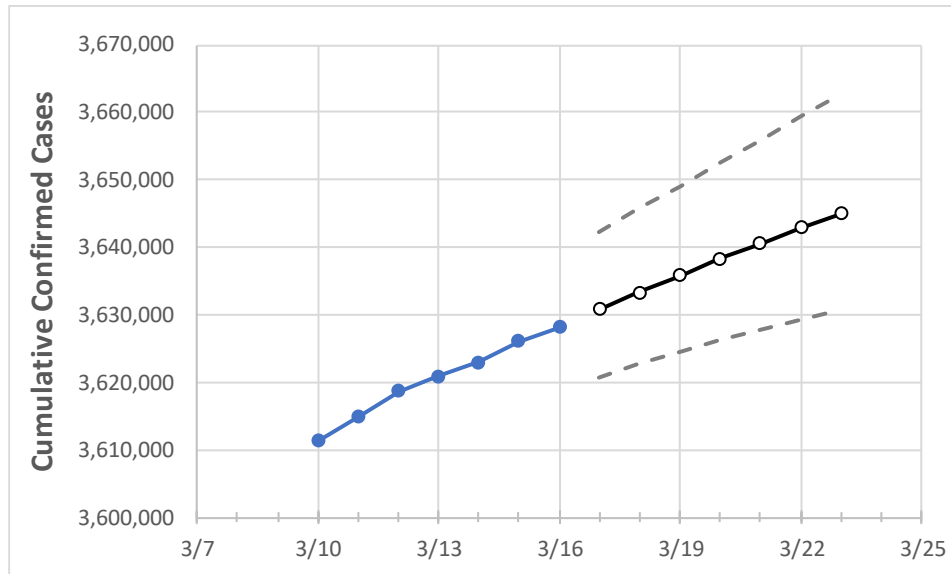
**IEM's Modeling Lead**

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:						
	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
California	3,620,890	3,623,063	3,626,027	3,628,171	3,630,794	3,633,380	3,635,892	3,638,298	3,640,622	3,642,862	3,645,066

*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:						
	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
Alameda	81,969	82,034	82,116	82,168	82,240	82,312	82,379	82,444	82,508	82,570	82,629
Contra Costa	63,943	64,056	64,096	64,203	64,286	64,366	64,444	64,525	64,598	64,672	64,743
Fresno	97,185	97,324	97,461	97,520	97,635	97,747	97,858	97,968	98,075	98,179	98,282
Kern	104,814	104,878	104,943	105,020	105,090	105,160	105,225	105,290	105,349	105,406	105,459
Lake	3,226	3,234	3,237	3,237	3,242	3,246	3,251	3,255	3,259	3,264	3,268
Los Angeles	1,209,661	1,210,270	1,210,663	1,210,961	1,211,945	1,212,920	1,213,801	1,214,694	1,215,549	1,216,350	1,217,169
Marin	13,445	13,450	13,462	13,462	13,474	13,485	13,496	13,507	13,517	13,526	13,536
Monterey	42,575	42,593	42,610	42,628	42,643	42,657	42,671	42,684	42,697	42,708	42,719
Orange	263,653	263,823	263,994	264,033	264,161	264,281	264,399	264,513	264,619	264,722	264,818
Placer	20,303	20,334	20,364	20,394	20,427	20,459	20,492	20,523	20,555	20,586	20,617
Riverside	292,008	292,151	292,293	292,403	292,515	292,623	292,724	292,824	292,927	293,017	293,105
Sacramento	95,140	95,192	95,441	95,556	95,667	95,782	95,892	95,999	96,104	96,208	96,308
San Bernardino	288,599	288,787	288,868	288,932	289,032	289,126	289,219	289,309	289,393	289,477	289,553
San Diego	265,273	265,471	265,649	265,906	266,169	266,424	266,669	266,912	267,157	267,389	267,611
San Francisco	34,758	34,784	34,810	34,820	34,844	34,868	34,890	34,910	34,931	34,949	34,968
San Joaquin	67,905	67,948	67,992	68,036	68,091	68,142	68,193	68,242	68,290	68,336	68,380
San Luis Obispo	20,053	20,066	20,078	20,115	20,137	20,157	20,177	20,197	20,216	20,234	20,251
San Mateo	39,638	39,689	39,744	39,765	39,800	39,835	39,868	39,900	39,929	39,958	39,986
Santa Barbara	32,595	32,621	32,634	32,669	32,698	32,727	32,754	32,781	32,806	32,831	32,854
Santa Clara	112,602	112,712	112,794	112,909	113,014	113,116	113,214	113,308	113,398	113,484	113,566
Santa Cruz	15,042	15,061	15,080	15,101	15,128	15,155	15,181	15,206	15,233	15,259	15,285
Solano	30,538	30,560	30,581	30,624	30,650	30,675	30,699	30,723	30,747	30,770	30,792
Sonoma	28,714	28,762	28,798	28,820	28,854	28,888	28,920	28,952	28,984	29,014	29,043
Ventura	78,739	78,766	78,792	78,871	78,919	78,965	79,009	79,051	79,091	79,129	79,162

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:											
	3/13	3/14	3/15	3/16	3/18				3/20				3/22			
Alameda	81,969	82,034	82,116	82,168	82,312	(16,462)	[3,951]	{1,975}	82,444	(16,489)	[3,957]	{1,979}	82,570	(16,514)	[3,963]	{1,982}
Contra Costa	63,943	64,056	64,096	64,203	64,366	(12,873)	[3,090]	{1,545}	64,525	(12,905)	[3,097]	{1,549}	64,672	(12,934)	[3,104]	{1,552}
Fresno	97,185	97,324	97,461	97,520	97,747	(19,549)	[4,692]	{2,346}	97,968	(19,594)	[4,702]	{2,351}	98,179	(19,636)	[4,713]	{2,356}
Kern	104,814	104,878	104,943	105,020	105,160	(21,032)	[5,048]	{2,524}	105,290	(21,058)	[5,054]	{2,527}	105,406	(21,081)	[5,059]	{2,530}
Lake	3,226	3,234	3,237	3,237	3,246	(649)	[156]	{78}	3,255	(651)	[156]	{78}	3,264	(653)	[157]	{78}
Los Angeles	1,209,661	1,210,270	1,210,663	1,210,961	1,212,920	(242,584)	[58,220]	{29,110}	1,214,694	(242,939)	[58,305]	{29,153}	1,216,350	(243,270)	[58,385]	{29,192}
Marin	13,445	13,450	13,462	13,462	13,485	(2,697)	[647]	{324}	13,507	(2,701)	[648]	{324}	13,526	(2,705)	[649]	{325}
Monterey	42,575	42,593	42,610	42,628	42,657	(8,531)	[2,048]	{1,024}	42,684	(8,537)	[2,049]	{1,024}	42,708	(8,542)	[2,050]	{1,025}
Orange	263,653	263,823	263,994	264,033	264,281	(52,856)	[12,685]	{6,343}	264,513	(52,903)	[12,697]	{6,348}	264,722	(52,944)	[12,707]	{6,353}
Placer	20,303	20,334	20,364	20,394	20,459	(4,092)	[982]	{491}	20,523	(4,105)	[985]	{493}	20,586	(4,117)	[988]	{494}
Riverside	292,008	292,151	292,293	292,403	292,623	(58,525)	[14,046]	{7,023}	292,824	(58,565)	[14,056]	{7,028}	293,017	(58,603)	[14,065]	{7,032}
Sacramento	95,140	95,192	95,441	95,556	95,782	(19,156)	[4,598]	{2,299}	95,999	(19,200)	[4,608]	{2,304}	96,208	(19,242)	[4,618]	{2,309}
San Bernardino	288,599	288,787	288,868	288,932	289,126	(57,825)	[13,878]	{6,939}	289,309	(57,862)	[13,887]	{6,943}	289,477	(57,895)	[13,895]	{6,947}
San Diego	265,273	265,471	265,649	265,906	266,424	(53,285)	[12,788]	{6,394}	266,912	(53,382)	[12,812]	{6,406}	267,389	(53,478)	[12,835]	{6,417}
San Francisco	34,758	34,784	34,810	34,820	34,868	(6,974)	[1,674]	{837}	34,910	(6,982)	[1,676]	{838}	34,949	(6,990)	[1,678]	{839}
San Joaquin	67,905	67,948	67,992	68,036	68,142	(13,628)	[3,271]	{1,635}	68,242	(13,648)	[3,276]	{1,638}	68,336	(13,667)	[3,280]	{1,640}
San Luis Obispo	20,053	20,066	20,078	20,115	20,157	(4,031)	[968]	{484}	20,197	(4,039)	[969]	{485}	20,234	(4,047)	[971]	{486}
San Mateo	39,638	39,689	39,744	39,765	39,835	(7,967)	[1,912]	{956}	39,900	(7,980)	[1,915]	{958}	39,958	(7,992)	[1,918]	{959}
Santa Barbara	32,595	32,621	32,634	32,669	32,727	(6,545)	[1,571]	{785}	32,781	(6,556)	[1,573]	{787}	32,831	(6,566)	[1,576]	{788}
Santa Clara	112,602	112,712	112,794	112,909	113,116	(22,623)	[5,430]	{2,715}	113,308	(22,662)	[5,439]	{2,719}	113,484	(22,697)	[5,447]	{2,724}
Santa Cruz	15,042	15,061	15,080	15,101	15,155	(3,031)	[727]	{364}	15,206	(3,041)	[730]	{365}	15,259	(3,052)	[732]	{366}
Solano	30,538	30,560	30,581	30,624	30,675	(6,135)	[1,472]	{736}	30,723	(6,145)	[1,475]	{737}	30,770	(6,154)	[1,477]	{738}
Sonoma	28,714	28,762	28,798	28,820	28,888	(5,778)	[1,387]	{693}	28,952	(5,790)	[1,390]	{695}	29,014	(5,803)	[1,393]	{696}
Ventura	78,739	78,766	78,792	78,871	78,965	(15,793)	[3,790]	{1,895}	79,051	(15,810)	[3,794]	{1,897}	79,129	(15,826)	[3,798]	{1,899}

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.