

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 1/11/21**

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 1/11/21 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.**

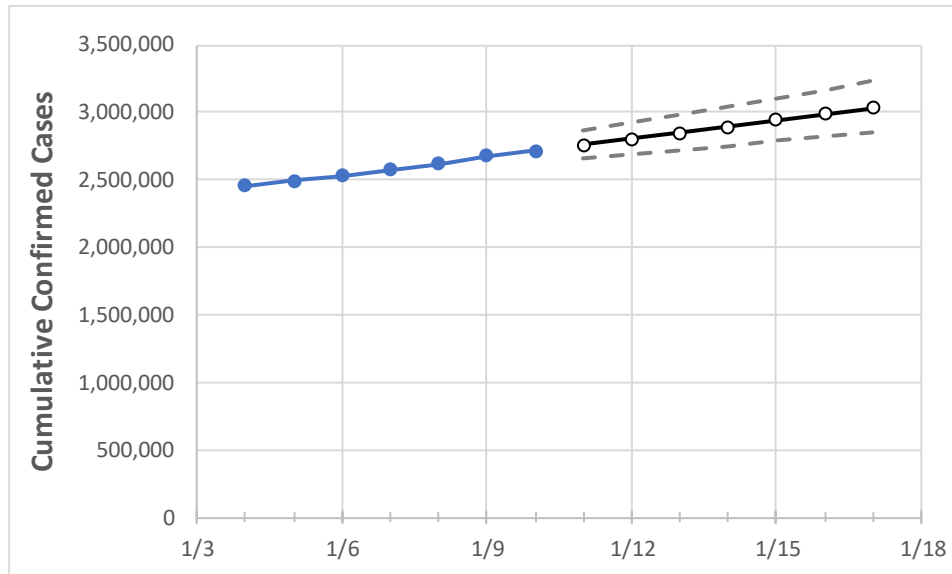
**IEM's Modeling Lead**

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:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
California	2,576,355	2,619,829	2,675,262	2,717,862	2,762,058	2,805,568	2,850,395	2,895,185	2,940,677	2,986,431	3,033,522

*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:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
Alameda	57,081	57,921	59,172	60,125	60,903	61,699	62,490	63,279	64,057	64,842	65,641
Contra Costa	44,967	45,793	46,618	47,315	48,108	48,920	49,755	50,638	51,511	52,420	53,368
Fresno	71,404	72,557	73,689	74,816	75,664	76,519	77,409	78,289	79,172	80,061	80,956
Kern	74,732	76,304	77,875	78,832	80,025	81,220	82,424	83,640	84,906	86,165	87,428
Lake	2,055	2,088	2,120	2,144	2,174	2,205	2,236	2,268	2,298	2,328	2,358
Los Angeles	872,204	889,405	907,077	920,324	935,883	951,840	968,043	984,560	1,001,479	1,018,762	1,035,984
Marin	10,468	10,582	10,696	10,811	10,935	11,066	11,200	11,342	11,489	11,641	11,800
Monterey	30,706	30,903	32,394	32,394	33,017	33,656	34,328	35,016	35,714	36,426	37,168
Orange	177,733	181,922	186,608	191,004	194,123	197,349	200,547	203,740	206,982	210,300	213,658
Placer	15,233	15,454	15,532	15,609	15,782	15,953	16,120	16,286	16,456	16,620	16,777
Riverside	204,327	208,177	212,122	216,076	219,148	221,995	224,929	227,825	230,746	233,591	236,404
Sacramento	71,572	72,342	73,245	74,482	75,291	76,105	76,911	77,701	78,487	79,296	80,064
San Bernardino	216,394	219,691	224,350	228,857	231,948	234,936	237,811	240,751	243,762	246,677	249,653
San Diego	180,512	185,062	188,600	191,888	195,780	199,788	203,897	208,008	212,266	216,595	221,029
San Francisco	25,424	25,885	26,378	26,708	27,065	27,421	27,787	28,167	28,549	28,938	29,330
San Joaquin	50,104	50,156	51,523	51,927	52,492	53,034	53,581	54,104	54,659	55,185	55,691
San Luis Obispo	12,597	12,810	13,286	13,647	14,017	14,415	14,818	15,260	15,722	16,204	16,716
San Mateo	27,050	27,494	28,072	28,512	28,962	29,419	29,885	30,363	30,845	31,350	31,868
Santa Barbara	19,953	20,252	20,550	21,323	21,842	22,380	22,944	23,544	24,160	24,816	25,487
Santa Clara	78,683	80,466	82,170	83,655	84,947	86,290	87,652	89,052	90,526	91,900	93,271
Santa Cruz	10,108	10,228	10,486	10,717	10,926	11,137	11,354	11,576	11,802	12,039	12,277
Solano	21,855	22,232	22,232	22,232	22,620	23,058	23,469	23,896	24,326	24,802	25,260
Sonoma	20,752	20,857	21,264	21,463	21,679	21,895	22,108	22,328	22,545	22,752	22,964
Ventura	47,428	49,083	50,553	51,988	53,406	54,874	56,363	57,924	59,515	61,158	62,856

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:											
	1/7	1/8	1/9	1/10	1/12				1/14				1/16			
Alameda	57,081	57,921	59,172	60,125	61,699	(12,340)	[2,962]	{1,481}	63,279	(12,656)	[3,037]	{1,519}	64,842	(12,968)	[3,112]	{1,556}
Contra Costa	44,967	45,793	46,618	47,315	48,920	(9,784)	[2,348]	{1,174}	50,638	(10,128)	[2,431]	{1,215}	52,420	(10,484)	[2,516]	{1,258}
Fresno	71,404	72,557	73,689	74,816	76,519	(15,304)	[3,673]	{1,836}	78,289	(15,658)	[3,758]	{1,879}	80,061	(16,012)	[3,843]	{1,921}
Kern	74,732	76,304	77,875	78,832	81,220	(16,244)	[3,899]	{1,949}	83,640	(16,728)	[4,015]	{2,007}	86,165	(17,233)	[4,136]	{2,068}
Lake	2,055	2,088	2,120	2,144	2,205	(441)	[106]	{53}	2,268	(454)	[109]	{54}	2,328	(466)	[112]	{56}
Los Angeles	872,204	889,405	907,077	920,324	951,840	(190,368)	[45,688]	{22,844}	984,560	(196,912)	[47,259]	{23,629}	1,018,762	(203,752)	[48,901]	{24,450}
Marin	10,468	10,582	10,696	10,811	11,066	(2,213)	[531]	{266}	11,342	(2,268)	[544]	{272}	11,641	(2,328)	[559]	{279}
Monterey	30,706	30,903	32,394	32,394	33,656	(6,731)	[1,615]	{808}	35,016	(7,003)	[1,681]	{840}	36,426	(7,285)	[1,748]	{874}
Orange	177,733	181,922	186,608	191,004	197,349	(39,470)	[9,473]	{4,736}	203,740	(40,748)	[9,780]	{4,890}	210,300	(42,060)	[10,094]	{5,047}
Placer	15,233	15,454	15,532	15,609	15,953	(3,191)	[766]	{383}	16,286	(3,257)	[782]	{391}	16,620	(3,324)	[798]	{399}
Riverside	204,327	208,177	212,122	216,076	221,995	(44,399)	[10,656]	{5,328}	227,825	(45,565)	[10,936]	{5,468}	233,591	(46,718)	[11,212]	{5,606}
Sacramento	71,572	72,342	73,245	74,482	76,105	(15,221)	[3,653]	{1,827}	77,701	(15,540)	[3,730]	{1,865}	79,296	(15,859)	[3,806]	{1,903}
San Bernardino	216,394	219,691	224,350	228,857	234,936	(46,987)	[11,277]	{5,638}	240,751	(48,150)	[11,556]	{5,778}	246,677	(49,335)	[11,840]	{5,920}
San Diego	180,512	185,062	188,600	191,888	199,788	(39,958)	[9,590]	{4,795}	208,008	(41,602)	[9,984]	{4,992}	216,595	(43,319)	[10,397]	{5,198}
San Francisco	25,424	25,885	26,378	26,708	27,421	(5,484)	[1,316]	{658}	28,167	(5,633)	[1,352]	{676}	28,938	(5,788)	[1,389]	{695}
San Joaquin	50,104	50,156	51,523	51,927	53,034	(10,607)	[2,546]	{1,273}	54,104	(10,821)	[2,597]	{1,299}	55,185	(11,037)	[2,649]	{1,324}
San Luis Obispo	12,597	12,810	13,286	13,647	14,415	(2,883)	[692]	{346}	15,260	(3,052)	[732]	{366}	16,204	(3,241)	[778]	{389}
San Mateo	27,050	27,494	28,072	28,512	29,419	(5,884)	[1,412]	{706}	30,363	(6,073)	[1,457]	{729}	31,350	(6,270)	[1,505]	{752}
Santa Barbara	19,953	20,252	20,550	21,323	22,380	(4,476)	[1,074]	{537}	23,544	(4,709)	[1,130]	{565}	24,816	(4,963)	[1,191]	{596}
Santa Clara	78,683	80,466	82,170	83,655	86,290	(17,258)	[4,142]	{2,071}	89,052	(17,810)	[4,275]	{2,137}	91,900	(18,380)	[4,411]	{2,206}
Santa Cruz	10,108	10,228	10,486	10,717	11,137	(2,227)	[535]	{267}	11,576	(2,315)	[556]	{278}	12,039	(2,408)	[578]	{289}
Solano	21,855	22,232	22,232	22,232	23,058	(4,612)	[1,107]	{553}	23,896	(4,779)	[1,147]	{574}	24,802	(4,960)	[1,191]	{595}
Sonoma	20,752	20,857	21,264	21,463	21,895	(4,379)	[1,051]	{525}	22,328	(4,466)	[1,072]	{536}	22,752	(4,550)	[1,092]	{546}
Ventura	47,428	49,083	50,553	51,988	54,874	(10,975)	[2,634]	{1,317}	57,924	(11,585)	[2,780]	{1,390}	61,158	(12,232)	[2,936]	{1,468}

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.