

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

Date: 11/19/20

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 11/19/20 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.**

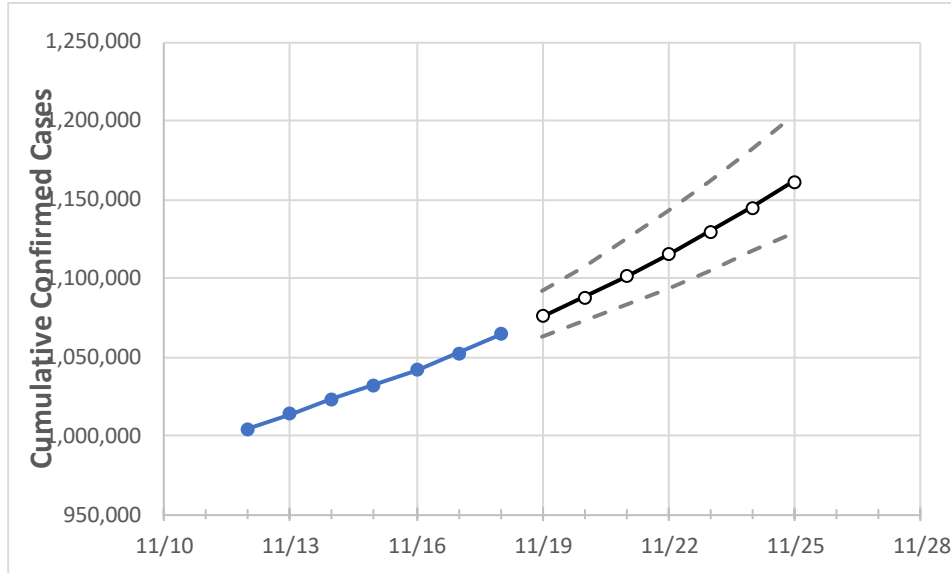
### IEM's Modeling Lead

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:					
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
California	1,032,095	1,041,690	1,052,285	1,064,040	1,075,703	1,088,027	1,101,049	1,114,805	1,129,338	1,144,690	1,160,906

*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:							
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25	
Alameda	25,872	26,047	26,460	26,655	26,878	27,112	27,358	27,618	27,891	28,178	28,480	
Contra Costa	21,046	21,250	21,458	21,630	21,857	22,097	22,350	22,617	22,900	23,198	23,513	
Fresno	33,969	34,297	34,593	34,765	35,071	35,396	35,741	36,106	36,494	36,906	37,342	
Kern	36,470	36,618	36,919	37,141	37,395	37,665	37,952	38,257	38,580	38,923	39,287	
Los Angeles	339,560	342,343	344,523	348,336	351,653	355,120	358,744	362,533	366,492	370,631	374,956	
Marin	7,358	7,378	7,409	7,448	7,475	7,503	7,533	7,564	7,598	7,634	7,671	
Monterey	12,854	13,034	13,110	13,220	13,347	13,481	13,622	13,770	13,926	14,090	14,263	
Orange	65,225	65,605	65,957	66,585	67,148	67,740	68,362	69,015	69,701	70,422	71,179	
Placer	5,215	5,397	5,489	5,543	5,630	5,723	5,821	5,925	6,035	6,152	6,275	
Riverside	74,910	75,848	76,724	77,636	78,446	79,312	80,236	81,223	82,277	83,403	84,604	
Sacramento	30,298	30,601	30,999	31,387	31,876	32,397	32,953	33,546	34,178	34,852	35,570	
San Bernardino	74,166	74,929	76,685	78,298	79,238	80,236	81,295	82,418	83,609	84,873	86,213	
San Diego	64,768	65,601	66,319	67,241	67,664	68,099	68,548	69,010	69,486	69,976	70,481	
San Francisco	13,665	13,757	13,847	13,952	14,082	14,219	14,362	14,511	14,668	14,832	15,004	
San Joaquin	23,589	23,662	23,734	24,171	24,281	24,397	24,519	24,648	24,784	24,927	25,078	
San Luis Obispo	5,073	5,120	5,250	5,321	5,419	5,524	5,637	5,758	5,890	6,031	6,183	
San Mateo	12,515	12,565	12,684	12,780	12,887	12,999	13,114	13,235	13,360	13,491	13,627	
Santa Barbara	10,482	10,516	10,577	10,612	10,666	10,723	10,783	10,846	10,911	10,980	11,052	
Santa Clara	28,307	28,686	29,023	29,297	29,672	30,068	30,485	30,925	31,389	31,879	32,395	
Santa Cruz	3,402	3,439	3,542	3,557	3,588	3,620	3,653	3,688	3,723	3,761	3,799	
Solano	8,882	8,959	9,088	9,161	9,263	9,367	9,475	9,585	9,698	9,815	9,935	
Sonoma	10,845	11,055	11,133	11,169	11,231	11,293	11,355	11,417	11,478	11,539	11,600	
Ventura	16,297	16,564	16,691	16,797	16,973	17,159	17,355	17,562	17,780	18,010	18,253	

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:											
	11/15	11/16	11/17	11/18	11/20		11/22		11/24							
Alameda	25,872	26,047	26,460	26,655	27,112	(5,422)	[1,301]	{651}	27,618	(5,524)	[1,326]	{663}	28,178	(5,636)	[1,353]	{676}
Contra Costa	21,046	21,250	21,458	21,630	22,097	(4,419)	[1,061]	{530}	22,617	(4,523)	[1,086]	{543}	23,198	(4,640)	[1,114]	{557}
Fresno	33,969	34,297	34,593	34,765	35,396	(7,079)	[1,699]	{850}	36,106	(7,221)	[1,733]	{867}	36,906	(7,381)	[1,771]	{886}
Kern	36,470	36,618	36,919	37,141	37,665	(7,533)	[1,808]	{904}	38,257	(7,651)	[1,836]	{918}	38,923	(7,785)	[1,868]	{934}
Los Angeles	339,560	342,343	344,523	348,336	355,120	(71,024)	[17,046]	{8,523}	362,533	(72,507)	[17,402]	{8,701}	370,631	(74,126)	[17,790]	{8,895}
Marin	7,358	7,378	7,409	7,448	7,503	(1,501)	[360]	{180}	7,564	(1,513)	[363]	{182}	7,634	(1,527)	[366]	{183}
Monterey	12,854	13,034	13,110	13,220	13,481	(2,696)	[647]	{324}	13,770	(2,754)	[661]	{330}	14,090	(2,818)	[676]	{338}
Orange	65,225	65,605	65,957	66,585	67,740	(13,548)	[3,252]	{1,626}	69,015	(13,803)	[3,313]	{1,656}	70,422	(14,084)	[3,380]	{1,690}
Placer	5,215	5,397	5,489	5,543	5,723	(1,145)	[275]	{137}	5,925	(1,185)	[284]	{142}	6,152	(1,230)	[295]	{148}
Riverside	74,910	75,848	76,724	77,636	79,312	(15,862)	[3,807]	{1,903}	81,223	(16,245)	[3,899]	{1,949}	83,403	(16,681)	[4,003]	{2,002}
Sacramento	30,298	30,601	30,999	31,387	32,397	(6,479)	[1,555]	{778}	33,546	(6,709)	[1,610]	{805}	34,852	(6,970)	[1,673]	{836}
San Bernardino	74,166	74,929	76,685	78,298	80,236	(16,047)	[3,851]	{1,926}	82,418	(16,484)	[3,956]	{1,978}	84,873	(16,975)	[4,074]	{2,037}
San Diego	64,768	65,601	66,319	67,241	68,099	(13,620)	[3,269]	{1,634}	69,010	(13,802)	[3,312]	{1,656}	69,976	(13,995)	[3,359]	{1,679}
San Francisco	13,665	13,757	13,847	13,952	14,219	(2,844)	[682]	{341}	14,511	(2,902)	[697]	{348}	14,832	(2,966)	[712]	{356}
San Joaquin	23,589	23,662	23,734	24,171	24,397	(4,879)	[1,171]	{586}	24,648	(4,930)	[1,183]	{592}	24,927	(4,985)	[1,197]	{598}
San Luis Obispo	5,073	5,120	5,250	5,321	5,524	(1,105)	[265]	{133}	5,758	(1,152)	[276]	{138}	6,031	(1,206)	[289]	{145}
San Mateo	12,515	12,565	12,684	12,780	12,999	(2,600)	[624]	{312}	13,235	(2,647)	[635]	{318}	13,491	(2,698)	[648]	{324}
Santa Barbara	10,482	10,516	10,577	10,612	10,723	(2,145)	[515]	{257}	10,846	(2,169)	[521]	{260}	10,980	(2,196)	[527]	{264}
Santa Clara	28,307	28,686	29,023	29,297	30,068	(6,014)	[1,443]	{722}	30,925	(6,185)	[1,484]	{742}	31,879	(6,376)	[1,530]	{765}
Santa Cruz	3,402	3,439	3,542	3,557	3,620	(724)	[174]	{87}	3,688	(738)	[177]	{89}	3,761	(752)	[181]	{90}
Solano	8,882	8,959	9,088	9,161	9,367	(1,873)	[450]	{225}	9,585	(1,917)	[460]	{230}	9,815	(1,963)	[471]	{236}
Sonoma	10,845	11,055	11,133	11,169	11,293	(2,259)	[542]	{271}	11,417	(2,283)	[548]	{274}	11,539	(2,308)	[554]	{277}
Ventura	16,297	16,564	16,691	16,797	17,159	(3,423)	[824]	{412}	17,562	(3,512)	[843]	{421}	18,010	(3,602)	[864]	{432}

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.