

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

**Date: 8/3/20**

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

The projections shown in this document are based on data pulled in as of 8/3/20 11 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.**

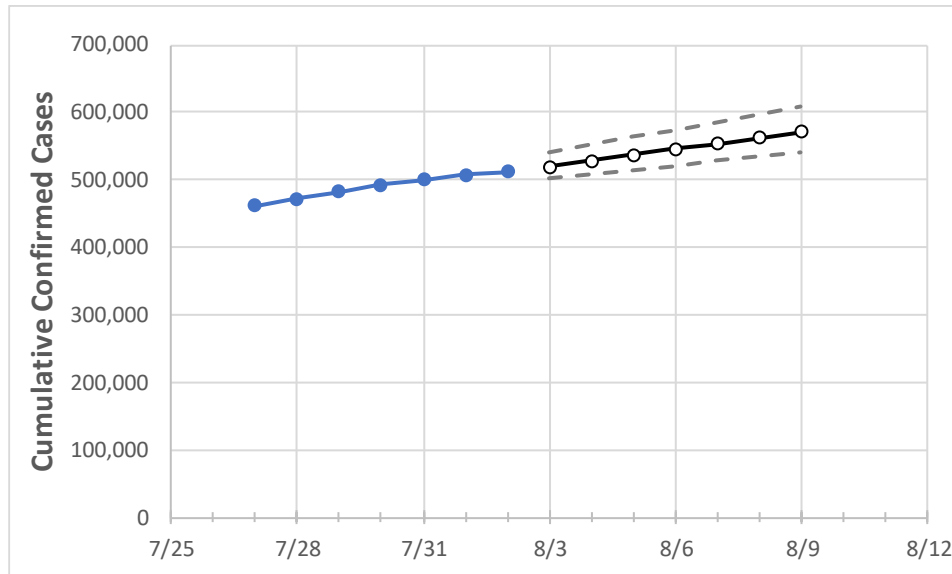
### **IEM's Modeling Lead**

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:							
	7/30	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	
California	492,309	500,421	507,242	511,556	520,025	528,482	536,927	545,361	553,782	562,190	570,584	

*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:						
	7/30	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9
Alameda	11,131	11,308	11,484	11,524	11,648	11,772	11,897	12,021	12,146	12,270	12,395
Contra Costa	7,624	7,670	7,806	7,966	8,113	8,262	8,412	8,563	8,717	8,872	9,029
Fresno	14,312	14,439	15,083	15,083	15,463	15,853	16,252	16,661	17,079	17,507	17,946
Kern	18,411	19,335	19,882	20,545	21,732	22,668	23,608	24,536	25,506	26,512	27,379
Los Angeles	185,872	188,481	190,693	192,167	194,570	196,967	199,360	201,747	204,130	206,508	208,880
Marin	4,931	4,987	4,987	4,987	5,132	5,288	5,456	5,637	5,832	6,042	6,268
Monterey	4,457	4,542	4,542	4,542	4,654	4,771	4,891	5,014	5,142	5,274	5,411
Orange	35,778	36,196	36,833	37,391	37,824	38,250	38,670	39,083	39,491	39,892	40,288
Placer	1,822	1,876	1,912	1,925	1,962	2,000	2,039	2,079	2,119	2,160	2,201
Riverside	36,629	37,011	37,011	37,011	37,562	38,116	38,672	39,231	39,792	40,355	40,920
Sacramento	9,664	9,820	10,016	10,067	10,233	10,399	10,563	10,726	10,888	11,049	11,209
San Bernardino	31,959	32,230	32,696	32,980	33,516	34,060	34,610	35,168	35,733	36,305	36,885
San Diego	28,668	29,048	29,577	29,883	30,294	30,704	31,115	31,525	31,936	32,347	32,757
San Francisco	6,423	6,575	6,723	6,811	6,939	7,072	7,209	7,351	7,498	7,651	7,809
San Joaquin	11,342	11,483	11,483	11,483	11,714	11,948	12,184	12,421	12,662	12,904	13,148
San Luis Obispo	1,740	1,783	1,783	1,783	1,828	1,874	1,921	1,970	2,020	2,072	2,125
San Mateo	5,398	5,469	5,544	5,544	5,626	5,709	5,793	5,879	5,966	6,055	6,145
Santa Barbara	6,094	6,167	6,167	6,167	6,273	6,381	6,491	6,603	6,717	6,834	6,952
Santa Clara	9,731	9,913	10,321	10,626	10,873	11,126	11,386	11,652	11,926	12,207	12,495
Santa Cruz	1,076	1,109	1,152	1,152	1,186	1,223	1,262	1,303	1,347	1,394	1,444
Solano	3,520	3,611	3,611	3,611	3,693	3,776	3,860	3,947	4,035	4,124	4,216
Sonoma	2,795	2,842	2,944	3,055	3,121	3,189	3,260	3,333	3,408	3,486	3,567
Ventura	7,103	7,344	7,344	7,344	7,493	7,644	7,799	7,956	8,117	8,281	8,449

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:											
	7/30	7/31	8/1	8/2	8/4				8/6				8/8			
Alameda	11,131	11,308	11,484	11,524	11,772	(2,354)	[565]	{283}	12,021	(2,404)	[577]	{289}	12,270	(2,454)	[589]	{294}
Contra Costa	7,624	7,670	7,806	7,966	8,262	(1,652)	[397]	{198}	8,563	(1,713)	[411]	{206}	8,872	(1,774)	[426]	{213}
Fresno	14,312	14,439	15,083	15,083	15,853	(3,171)	[761]	{380}	16,661	(3,332)	[800]	{400}	17,507	(3,501)	[840]	{420}
Kern	18,411	19,335	19,882	20,545	22,668	(4,534)	[1,088]	{544}	24,536	(4,907)	[1,178]	{589}	26,512	(5,302)	[1,273]	{636}
Los Angeles	185,872	188,481	190,693	192,167	196,967	(39,393)	[9,454]	{4,727}	201,747	(40,349)	[9,684]	{4,842}	206,508	(41,302)	[9,912]	{4,956}
Marin	4,931	4,987	4,987	4,987	5,288	(1,058)	[254]	{127}	5,637	(1,127)	[271]	{135}	6,042	(1,208)	[290]	{145}
Monterey	4,457	4,542	4,542	4,542	4,771	(954)	[229]	{114}	5,014	(1,003)	[241]	{120}	5,274	(1,055)	[253]	{127}
Orange	35,778	36,196	36,833	37,391	38,250	(7,650)	[1,836]	{918}	39,083	(7,817)	[1,876]	{938}	39,892	(7,978)	[1,915]	{957}
Placer	1,822	1,876	1,912	1,925	2,000	(400)	[96]	{48}	2,079	(416)	[100]	{50}	2,160	(432)	[104]	{52}
Riverside	36,629	37,011	37,011	37,011	38,116	(7,623)	[1,830]	{915}	39,231	(7,846)	[1,883]	{942}	40,355	(8,071)	[1,937]	{969}
Sacramento	9,664	9,820	10,016	10,067	10,399	(2,080)	[499]	{250}	10,726	(2,145)	[515]	{257}	11,049	(2,210)	[530]	{265}
San Bernardino	31,959	32,230	32,696	32,980	34,060	(6,812)	[1,635]	{817}	35,168	(7,034)	[1,688]	{844}	36,305	(7,261)	[1,743]	{871}
San Diego	28,668	29,048	29,577	29,883	30,704	(6,141)	[1,474]	{737}	31,525	(6,305)	[1,513]	{757}	32,347	(6,469)	[1,553]	{776}
San Francisco	6,423	6,575	6,723	6,811	7,072	(1,414)	[339]	{170}	7,351	(1,470)	[353]	{176}	7,651	(1,530)	[367]	{184}
San Joaquin	11,342	11,483	11,483	11,483	11,948	(2,390)	[573]	{287}	12,421	(2,484)	[596]	{298}	12,904	(2,581)	[619]	{310}
San Luis Obispo	1,740	1,783	1,783	1,783	1,874	(375)	[90]	{45}	1,970	(394)	[95]	{47}	2,072	(414)	[99]	{50}
San Mateo	5,398	5,469	5,544	5,544	5,709	(1,142)	[274]	{137}	5,879	(1,176)	[282]	{141}	6,055	(1,211)	[291]	{145}
Santa Barbara	6,094	6,167	6,167	6,167	6,381	(1,276)	[306]	{153}	6,603	(1,321)	[317]	{158}	6,834	(1,367)	[328]	{164}
Santa Clara	9,731	9,913	10,321	10,626	11,126	(2,225)	[534]	{267}	11,652	(2,330)	[559]	{280}	12,207	(2,441)	[586]	{293}
Santa Cruz	1,076	1,109	1,152	1,152	1,223	(245)	[59]	{29}	1,303	(261)	[63]	{31}	1,394	(279)	[67]	{33}
Solano	3,520	3,611	3,611	3,611	3,776	(755)	[181]	{91}	3,947	(789)	[189]	{95}	4,124	(825)	[198]	{99}
Sonoma	2,795	2,842	2,944	3,055	3,189	(638)	[153]	{77}	3,333	(667)	[160]	{80}	3,486	(697)	[167]	{84}
Ventura	7,103	7,344	7,344	7,344	7,644	(1,529)	[367]	{183}	7,956	(1,591)	[382]	{191}	8,281	(1,656)	[398]	{199}

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.