

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

**Date: 10/28/20**

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 10/28/20 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.**

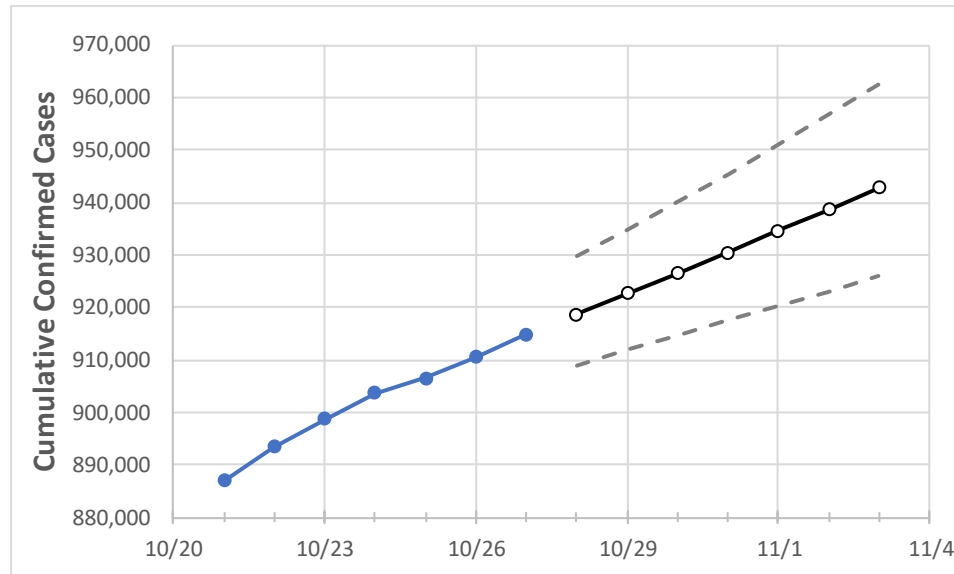
### **IEM's Modeling Lead**

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:					
	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	
California	903,684	906,596	910,438	914,888	918,720	922,602	926,533	930,515	934,547	938,630	942,764	

*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:						
	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3
Alameda	23,215	23,312	23,391	23,471	23,565	23,663	23,763	23,867	23,974	24,084	24,198
Contra Costa	18,523	18,621	18,694	18,763	18,832	18,902	18,972	19,042	19,114	19,186	19,258
Fresno	30,590	30,752	30,858	30,969	31,083	31,201	31,321	31,443	31,569	31,698	31,830
Kern	33,775	33,813	33,881	33,928	33,988	34,047	34,106	34,165	34,223	34,281	34,339
Los Angeles	298,937	299,760	300,614	302,077	303,188	304,314	305,456	306,614	307,788	308,977	310,183
Marin	7,057	7,074	7,089	7,096	7,105	7,114	7,123	7,132	7,141	7,150	7,158
Monterey	11,321	11,372	11,399	11,419	11,461	11,502	11,543	11,584	11,624	11,663	11,703
Orange	58,326	58,573	58,725	58,980	59,202	59,427	59,657	59,891	60,129	60,372	60,620
Placer	4,091	4,093	4,178	4,207	4,221	4,236	4,251	4,266	4,281	4,296	4,312
Riverside	65,830	65,902	66,732	66,993	67,267	67,550	67,842	68,142	68,452	68,772	69,101
Sacramento	25,264	25,372	25,445	25,601	25,727	25,855	25,985	26,117	26,252	26,390	26,530
San Bernardino	62,353	62,619	62,774	63,367	63,676	63,992	64,317	64,650	64,991	65,341	65,700
San Diego	54,314	54,583	54,941	55,210	55,526	55,847	56,172	56,501	56,835	57,174	57,517
San Francisco	12,069	12,103	12,152	12,189	12,227	12,265	12,304	12,343	12,383	12,424	12,465
San Joaquin	21,630	21,663	21,696	21,729	21,748	21,767	21,785	21,803	21,821	21,838	21,856
San Luis Obispo	4,141	4,152	4,163	4,174	4,191	4,208	4,225	4,242	4,259	4,276	4,294
San Mateo	11,075	11,112	11,149	11,198	11,238	11,279	11,319	11,360	11,401	11,442	11,484
Santa Barbara	9,760	9,781	9,814	9,827	9,851	9,876	9,901	9,925	9,950	9,975	10,001
Santa Clara	24,014	24,144	24,313	24,425	24,559	24,696	24,837	24,981	25,128	25,279	25,434
Santa Cruz	2,771	2,788	2,802	2,808	2,820	2,832	2,843	2,855	2,867	2,879	2,891
Solano	7,319	7,351	7,384	7,445	7,488	7,531	7,575	7,619	7,664	7,709	7,755
Sonoma	9,238	9,312	9,402	9,494	9,560	9,627	9,694	9,762	9,830	9,899	9,969
Ventura	14,192	14,240	14,300	14,330	14,382	14,435	14,489	14,543	14,598	14,654	14,710

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:							
	10/24	10/25	10/26	10/27	10/29		10/31		11/2			
Alameda	23,215	23,312	23,391	23,471	23,663	(4,733) [1,136] {568}	23,867	(4,773) [1,146] {573}	24,084	(4,817) [1,156] {578}		
Contra Costa	18,523	18,621	18,694	18,763	18,902	(3,780) [907] {454}	19,042	(3,808) [914] {457}	19,186	(3,837) [921] {460}		
Fresno	30,590	30,752	30,858	30,969	31,201	(6,240) [1,498] {749}	31,443	(6,289) [1,509] {755}	31,698	(6,340) [1,522] {761}		
Kern	33,775	33,813	33,881	33,928	34,047	(6,809) [1,634] {817}	34,165	(6,833) [1,640] {820}	34,281	(6,856) [1,646] {823}		
Los Angeles	298,937	299,760	300,614	302,077	304,314	(60,863) [14,607] {7,304}	306,614	(61,323) [14,717] {7,359}	308,977	(61,795) [14,831] {7,415}		
Marin	7,057	7,074	7,089	7,096	7,114	(1,423) [341] {171}	7,132	(1,426) [342] {171}	7,150	(1,430) [343] {172}		
Monterey	11,321	11,372	11,399	11,419	11,502	(2,300) [552] {276}	11,584	(2,317) [556] {278}	11,663	(2,333) [560] {280}		
Orange	58,326	58,573	58,725	58,980	59,427	(11,885) [2,853] {1,426}	59,891	(11,978) [2,875] {1,437}	60,372	(12,074) [2,898] {1,449}		
Placer	4,091	4,093	4,178	4,207	4,236	(847) [203] {102}	4,266	(853) [205] {102}	4,296	(859) [206] {103}		
Riverside	65,830	65,902	66,732	66,993	67,550	(13,510) [3,242] {1,621}	68,142	(13,628) [3,271] {1,635}	68,772	(13,754) [3,301] {1,651}		
Sacramento	25,264	25,372	25,445	25,601	25,855	(5,171) [1,241] {621}	26,117	(5,223) [1,254] {627}	26,390	(5,278) [1,267] {633}		
San Bernardino	62,353	62,619	62,774	63,367	63,992	(12,798) [3,072] {1,536}	64,650	(12,930) [3,103] {1,552}	65,341	(13,068) [3,136] {1,568}		
San Diego	54,314	54,583	54,941	55,210	55,847	(11,169) [2,681] {1,340}	56,501	(11,300) [2,712] {1,356}	57,174	(11,435) [2,744] {1,372}		
San Francisco	12,069	12,103	12,152	12,189	12,265	(2,453) [589] {294}	12,343	(2,469) [592] {296}	12,424	(2,485) [596] {298}		
San Joaquin	21,630	21,663	21,696	21,729	21,767	(4,353) [1,045] {522}	21,803	(4,361) [1,047] {523}	21,838	(4,368) [1,048] {524}		
San Luis Obispo	4,141	4,152	4,163	4,174	4,208	(842) [202] {101}	4,242	(848) [204] {102}	4,276	(855) [205] {103}		
San Mateo	11,075	11,112	11,149	11,198	11,279	(2,256) [541] {271}	11,360	(2,272) [545] {273}	11,442	(2,288) [549] {275}		
Santa Barbara	9,760	9,781	9,814	9,827	9,876	(1,975) [474] {237}	9,925	(1,985) [476] {238}	9,975	(1,995) [479] {239}		
Santa Clara	24,014	24,144	24,313	24,425	24,696	(4,939) [1,185] {593}	24,981	(4,996) [1,199] {600}	25,279	(5,056) [1,213] {607}		
Santa Cruz	2,771	2,788	2,802	2,808	2,832	(566) [136] {68}	2,855	(571) [137] {69}	2,879	(576) [138] {69}		
Solano	7,319	7,351	7,384	7,445	7,531	(1,506) [361] {181}	7,619	(1,524) [366] {183}	7,709	(1,542) [370] {185}		
Sonoma	9,238	9,312	9,402	9,494	9,627	(1,925) [462] {231}	9,762	(1,952) [469] {234}	9,899	(1,980) [475] {238}		
Ventura	14,192	14,240	14,300	14,330	14,435	(2,887) [693] {346}	14,543	(2,909) [698] {349}	14,654	(2,931) [703] {352}		

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