

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 9/13/21**

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 9/13/21 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.

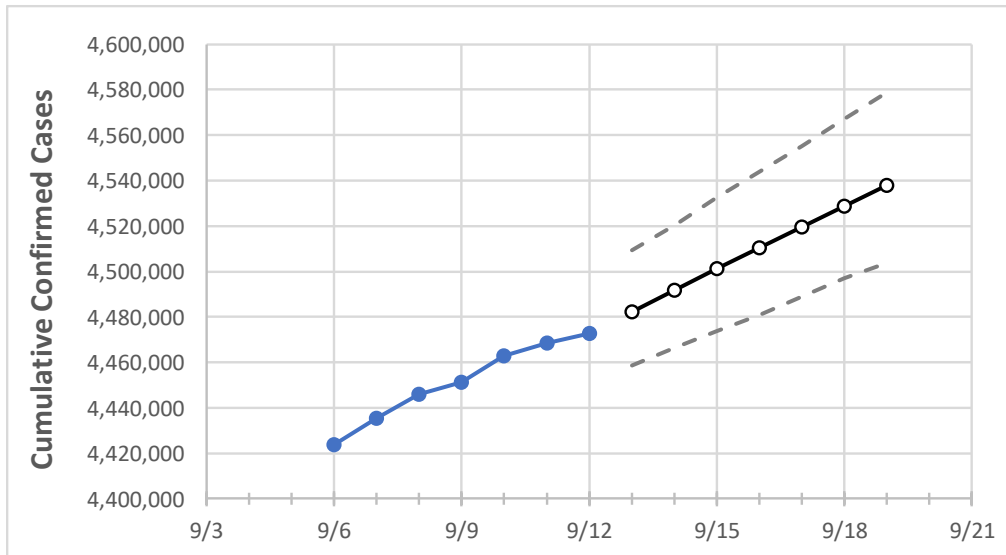
IEM's Modeling Lead

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:						
	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19
California	4,451,347	4,462,876	4,468,594	4,472,759	4,482,196	4,491,701	4,501,264	4,510,334	4,519,457	4,528,750	4,537,907

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:						
	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19
Alameda	111,422	111,628	111,992	111,715	112,044	112,372	112,692	113,016	113,329	113,666	113,992
Contra Costa	91,471	91,687	92,024	92,269	92,573	92,888	93,211	93,534	93,837	94,170	94,477
Fresno	120,644	121,040	121,659	122,224	122,801	123,379	123,941	124,531	125,127	125,735	126,330
Kern	129,808	130,375	130,375	130,375	130,958	131,548	132,140	132,734	133,333	133,950	134,570
Lake	5,618	5,638	5,713	5,761	5,797	5,836	5,874	5,913	5,952	5,993	6,033
Los Angeles	1,425,719	1,427,817	1,427,817	1,427,817	1,429,574	1,431,379	1,433,069	1,434,721	1,436,384	1,438,050	1,439,649
Marin	16,386	16,416	16,458	16,496	16,513	16,528	16,542	16,556	16,570	16,584	16,597
Monterey	46,684	46,684	46,684	46,684	46,759	46,839	46,921	46,997	47,083	47,165	47,247
Orange	309,576	310,195	310,195	310,195	310,619	311,047	311,457	311,880	312,280	312,686	313,083
Placer	31,991	32,095	32,264	32,414	32,646	32,832	33,057	33,276	33,515	33,725	33,971
Riverside	337,921	337,921	337,921	337,921	338,861	339,781	340,740	341,674	342,626	343,591	344,501
Sacramento	142,448	142,728	143,244	143,557	144,386	145,252	146,047	146,860	147,737	148,602	149,416
San Bernardino	336,417	336,719	336,719	336,719	337,353	338,109	338,629	339,331	340,015	340,650	341,295
San Diego	342,149	343,173	344,356	345,059	345,928	346,758	347,585	348,404	349,245	350,045	350,842
San Francisco	48,263	48,404	48,518	48,660	48,790	48,915	49,042	49,169	49,294	49,423	49,544
San Joaquin	89,631	89,874	90,208	90,482	90,871	91,268	91,647	92,008	92,427	92,845	93,240
San Luis Obispo	26,303	26,472	26,526	26,651	26,749	26,851	26,943	27,040	27,136	27,241	27,336
San Mateo	50,051	50,143	50,251	50,341	50,464	50,592	50,716	50,835	50,964	51,084	51,211
Santa Barbara	40,000	40,180	40,321	40,451	40,556	40,657	40,762	40,866	40,969	41,074	41,178
Santa Clara	137,582	137,915	137,915	137,915	138,304	138,708	139,064	139,507	139,896	140,287	140,724
Santa Cruz	18,774	18,780	18,785	18,865	18,905	18,949	18,995	19,035	19,079	19,121	19,162
Solano	42,555	42,665	42,665	42,665	42,898	43,117	43,339	43,560	43,787	44,029	44,243
Sonoma	38,315	38,413	38,520	38,520	38,668	38,829	38,989	39,154	39,308	39,482	39,642
Ventura	91,563	92,072	92,145	92,328	92,499	92,659	92,820	92,989	93,146	93,320	93,493

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:											
	9/9	9/10	9/11	9/12	9/14				9/16				9/18			
Alameda	111,422	111,628	111,992	111,715	112,372	(22,474)	[5,394]	{2,697}	113,016	(22,603)	[5,425]	{2,712}	113,666	(22,733)	[5,456]	{2,728}
Contra Costa	91,471	91,687	92,024	92,269	92,888	(18,578)	[4,459]	{2,229}	93,534	(18,707)	[4,490]	{2,245}	94,170	(18,834)	[4,520]	{2,260}
Fresno	120,644	121,040	121,659	122,224	123,379	(24,676)	[5,922]	{2,961}	124,531	(24,906)	[5,978]	{2,989}	125,735	(25,147)	[6,035]	{3,018}
Kern	129,808	130,375	130,375	130,375	131,548	(26,310)	[6,314]	{3,157}	132,734	(26,547)	[6,371]	{3,186}	133,950	(26,790)	[6,430]	{3,215}
Lake	5,618	5,638	5,713	5,761	5,836	(1,167)	[280]	{140}	5,913	(1,183)	[284]	{142}	5,993	(1,199)	[288]	{144}
Los Angeles	1,425,719	1,427,817	1,427,817	1,427,817	1,431,379	(286,276)	[68,706]	{34,353}	1,434,721	(286,944)	[68,867]	{34,433}	1,438,050	(287,610)	[69,026]	{34,513}
Marin	16,386	16,416	16,458	16,496	16,528	(3,306)	[793]	{397}	16,556	(3,311)	[795]	{397}	16,584	(3,317)	[796]	{398}
Monterey	46,684	46,684	46,684	46,684	46,839	(9,368)	[2,248]	{1,124}	46,997	(9,399)	[2,256]	{1,128}	47,165	(9,433)	[2,264]	{1,132}
Orange	309,576	310,195	310,195	310,195	311,047	(62,209)	[14,930]	{7,465}	311,880	(62,376)	[14,970]	{7,485}	312,686	(62,537)	[15,009]	{7,504}
Placer	31,991	32,095	32,264	32,414	32,832	(6,566)	[1,576]	{788}	33,276	(6,655)	[1,597]	{799}	33,725	(6,745)	[1,619]	{809}
Riverside	337,921	337,921	337,921	337,921	339,781	(67,956)	[16,310]	{8,155}	341,674	(68,335)	[16,400]	{8,200}	343,591	(68,718)	[16,492]	{8,246}
Sacramento	142,448	142,728	143,244	143,557	145,252	(29,050)	[6,972]	{3,486}	146,860	(29,372)	[7,049]	{3,525}	148,602	(29,720)	[7,133]	{3,566}
San Bernardino	336,417	336,719	336,719	336,719	338,109	(67,622)	[16,229]	{8,115}	339,331	(67,866)	[16,288]	{8,144}	340,650	(68,130)	[16,351]	{8,176}
San Diego	342,149	343,173	344,356	345,059	346,758	(69,352)	[16,644]	{8,322}	348,404	(69,681)	[16,723]	{8,362}	350,045	(70,009)	[16,802]	{8,401}
San Francisco	48,263	48,404	48,518	48,660	48,915	(9,783)	[2,348]	{1,174}	49,169	(9,834)	[2,360]	{1,180}	49,423	(9,885)	[2,372]	{1,186}
San Joaquin	89,631	89,874	90,208	90,482	91,268	(18,254)	[4,381]	{2,190}	92,008	(18,402)	[4,416]	{2,208}	92,845	(18,569)	[4,457]	{2,228}
San Luis Obispo	26,303	26,472	26,526	26,651	26,851	(5,370)	[1,289]	{644}	27,040	(5,408)	[1,298]	{649}	27,241	(5,448)	[1,308]	{654}
San Mateo	50,051	50,143	50,251	50,341	50,592	(10,118)	[2,428]	{1,214}	50,835	(10,167)	[2,440]	{1,220}	51,084	(10,217)	[2,452]	{1,226}
Santa Barbara	40,000	40,180	40,321	40,451	40,657	(8,131)	[1,952]	{976}	40,866	(8,173)	[1,962]	{981}	41,074	(8,215)	[1,972]	{986}
Santa Clara	137,582	137,915	137,915	137,915	138,708	(27,742)	[6,658]	{3,329}	139,507	(27,901)	[6,696]	{3,348}	140,287	(28,057)	[6,734]	{3,367}
Santa Cruz	18,774	18,780	18,785	18,865	18,949	(3,790)	[910]	{455}	19,035	(3,807)	[914]	{457}	19,121	(3,824)	[918]	{459}
Solano	42,555	42,665	42,665	42,665	43,117	(8,623)	[2,070]	{1,035}	43,560	(8,712)	[2,091]	{1,045}	44,029	(8,806)	[2,113]	{1,057}
Sonoma	38,315	38,413	38,520	38,520	38,829	(7,766)	[1,864]	{932}	39,154	(7,831)	[1,879]	{940}	39,482	(7,896)	[1,895]	{948}
Ventura	91,563	92,072	92,145	92,328	92,659	(18,532)	[4,448]	{2,224}	92,989	(18,598)	[4,463]	{2,232}	93,320	(18,664)	[4,479]	{2,240}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.