

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/13/21**

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 10/13/21 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.

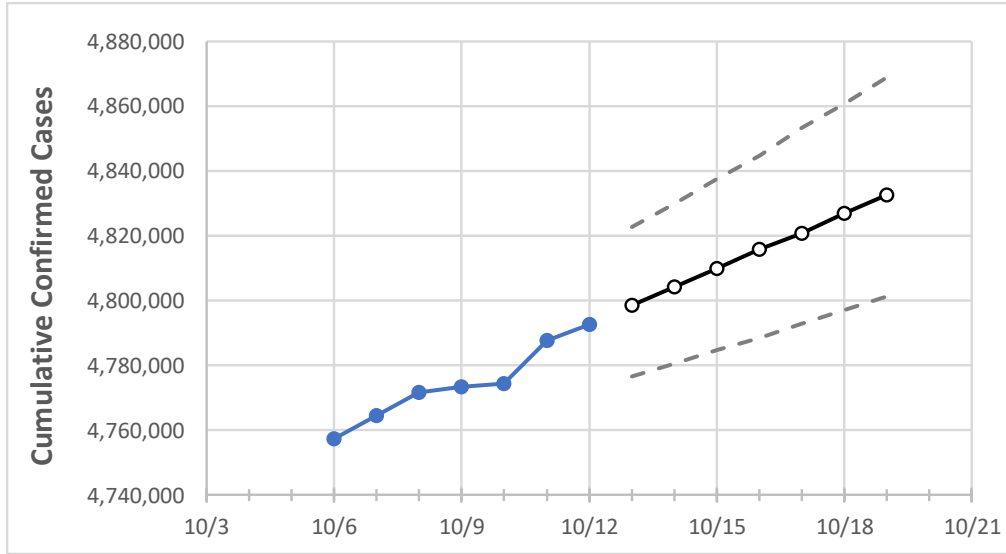
IEM's Modeling Lead

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:						
	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19
California	4,773,284	4,774,445	4,787,635	4,792,729	4,798,483	4,804,267	4,809,876	4,815,768	4,820,776	4,826,862	4,832,473

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:						
	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19
Alameda	119,232	119,374	119,516	119,596	119,728	119,859	119,990	120,117	120,244	120,372	120,500
Contra Costa	98,597	98,725	98,852	98,924	99,047	99,171	99,296	99,417	99,538	99,660	99,778
Fresno	142,334	142,642	142,951	143,220	143,535	143,853	144,168	144,483	144,797	145,112	145,428
Kern	142,139	142,388	142,637	142,932	143,224	143,514	143,795	144,075	144,356	144,633	144,905
Lake	6,433	6,455	6,477	6,489	6,506	6,524	6,540	6,557	6,574	6,591	6,607
Los Angeles	1,469,790	1,470,829	1,471,645	1,472,419	1,473,408	1,474,404	1,475,341	1,476,300	1,477,250	1,478,195	1,479,104
Marin	17,495	17,516	17,537	17,546	17,564	17,581	17,599	17,616	17,635	17,651	17,669
Monterey	50,526	50,546	50,566	50,579	50,621	50,666	50,707	50,749	50,792	50,841	50,874
Orange	321,381	321,616	321,850	322,084	322,325	322,558	322,784	323,012	323,238	323,457	323,667
Placer	38,461	38,544	38,628	38,673	38,757	38,840	38,926	39,007	39,093	39,176	39,263
Riverside	367,290	367,678	368,067	368,263	368,641	369,007	369,372	369,744	370,103	370,466	370,818
Sacramento	156,054	156,333	156,613	156,889	157,153	157,419	157,688	157,952	158,216	158,476	158,741
San Bernardino	354,654	354,977	355,301	355,472	355,783	356,086	356,390	356,694	356,993	357,295	357,594
San Diego	360,917	361,039	361,719	362,293	362,764	363,231	363,677	364,121	364,577	365,016	365,466
San Francisco	53,601	53,687	53,772	53,831	53,909	53,986	54,061	54,136	54,213	54,290	54,365
San Joaquin	100,989	101,149	101,308	101,376	101,511	101,648	101,779	101,906	102,035	102,161	102,287
San Luis Obispo	29,429	29,477	29,526	29,538	29,583	29,629	29,672	29,715	29,760	29,802	29,847
San Mateo	53,568	53,618	53,669	53,694	53,750	53,805	53,856	53,908	53,961	54,014	54,065
Santa Barbara	44,463	44,547	44,631	44,662	44,722	44,781	44,843	44,903	44,959	45,025	45,079
Santa Clara	143,655	143,811	143,968	144,036	144,180	144,321	144,464	144,602	144,745	144,888	145,026
Santa Cruz	20,728	20,758	20,789	20,807	20,839	20,868	20,899	20,930	20,961	20,993	21,024
Solano	45,485	45,541	45,596	45,639	45,698	45,755	45,812	45,869	45,925	45,981	46,037
Sonoma	40,416	40,475	40,535	40,575	40,625	40,675	40,725	40,776	40,826	40,876	40,925
Ventura	99,953	100,048	100,144	100,191	100,287	100,380	100,473	100,566	100,656	100,747	100,837

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:									
	10/9	10/10	10/11	10/12	10/14		10/16		10/18					
Alameda	119,232	119,374	119,516	119,596	119,859	{23,972}	{5,753}	{2,877}	120,117	{24,023}	{5,766}	{2,883}	120,372	{24,074} {5,778} {2,889}
Contra Costa	98,597	98,725	98,852	98,924	99,171	{19,834}	{4,760}	{2,380}	99,417	{19,883}	{4,772}	{2,386}	99,660	{19,932} {4,784} {2,392}
Fresno	142,334	142,642	142,951	143,220	143,853	{28,771}	{6,905}	{3,452}	144,483	{28,897}	{6,935}	{3,468}	145,112	{29,022} {6,965} {3,483}
Kern	142,139	142,388	142,637	142,932	143,514	{28,703}	{6,889}	{3,444}	144,075	{28,815}	{6,916}	{3,458}	144,633	{28,927} {6,942} {3,471}
Lake	6,433	6,455	6,477	6,489	6,524	{1,305}	{313}	{157}	6,557	{1,311}	{315}	{157}	6,591	{1,318} {316} {158}
Los Angeles	1,469,790	1,470,829	1,471,645	1,472,419	1,474,404	{294,881}	{70,771}	{35,386}	1,476,300	{295,260}	{70,862}	{35,431}	1,478,195	{295,639} {70,953} {35,477}
Marin	17,495	17,516	17,537	17,546	17,581	{3,516}	{844}	{422}	17,616	{3,523}	{846}	{423}	17,651	{3,530} {847} {424}
Monterey	50,526	50,546	50,566	50,579	50,666	{10,133}	{2,432}	{1,216}	50,749	{10,150}	{2,436}	{1,218}	50,841	{10,168} {2,440} {1,220}
Orange	321,381	321,616	321,850	322,084	322,558	{64,512}	{15,483}	{7,741}	323,012	{64,602}	{15,505}	{7,752}	323,457	{64,691} {15,526} {7,763}
Placer	38,461	38,544	38,628	38,673	38,840	{7,768}	{1,864}	{932}	39,007	{7,801}	{1,872}	{936}	39,176	{7,835} {1,880} {940}
Riverside	367,290	367,678	368,067	368,263	369,007	{73,801}	{17,712}	{8,856}	369,744	{73,949}	{17,748}	{8,874}	370,466	{74,093} {17,782} {8,891}
Sacramento	156,054	156,333	156,613	156,889	157,419	{31,484}	{7,556}	{3,778}	157,952	{31,590}	{7,582}	{3,791}	158,476	{31,695} {7,607} {3,803}
San Bernardino	354,654	354,977	355,301	355,472	356,086	{71,217}	{17,092}	{8,546}	356,694	{71,339}	{17,121}	{8,561}	357,295	{71,459} {17,150} {8,575}
San Diego	360,917	361,039	361,719	362,293	363,231	{72,646}	{17,435}	{8,718}	364,121	{72,824}	{17,478}	{8,739}	365,016	{73,003} {17,521} {8,760}
San Francisco	53,601	53,687	53,772	53,831	53,986	{10,797}	{2,591}	{1,296}	54,136	{10,827}	{2,599}	{1,299}	54,290	{10,858} {2,606} {1,303}
San Joaquin	100,989	101,149	101,308	101,376	101,648	{20,330}	{4,879}	{2,440}	101,906	{20,381}	{4,891}	{2,446}	102,161	{20,432} {4,904} {2,452}
San Luis Obispo	29,429	29,477	29,526	29,538	29,629	{5,926}	{1,422}	{711}	29,715	{5,943}	{1,426}	{713}	29,802	{5,960} {1,430} {715}
San Mateo	53,568	53,618	53,669	53,694	53,805	{10,761}	{2,583}	{1,291}	53,908	{10,782}	{2,588}	{1,294}	54,014	{10,803} {2,593} {1,296}
Santa Barbara	44,463	44,547	44,631	44,662	44,781	{8,956}	{2,149}	{1,075}	44,903	{8,981}	{2,155}	{1,078}	45,025	{9,005} {2,161} {1,081}
Santa Clara	143,655	143,811	143,968	144,036	144,321	{28,864}	{6,927}	{3,464}	144,602	{28,920}	{6,941}	{3,470}	144,888	{28,978} {6,955} {3,477}
Santa Cruz	20,728	20,758	20,789	20,807	20,868	{4,174}	{1,002}	{501}	20,930	{4,186}	{1,005}	{502}	20,993	{4,199} {1,008} {504}
Solano	45,485	45,541	45,596	45,639	45,755	{9,151}	{2,196}	{1,098}	45,869	{9,174}	{2,202}	{1,101}	45,981	{9,196} {2,207} {1,104}
Sonoma	40,416	40,475	40,535	40,575	40,675	{8,135}	{1,952}	{976}	40,776	{8,155}	{1,957}	{979}	40,876	{8,175} {1,962} {981}
Ventura	99,953	100,048	100,144	100,191	100,380	{20,076}	{4,818}	{2,409}	100,566	{20,113}	{4,827}	{2,414}	100,747	{20,149} {4,836} {2,418}

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.