

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 11/12/20**

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 11/12/20 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.

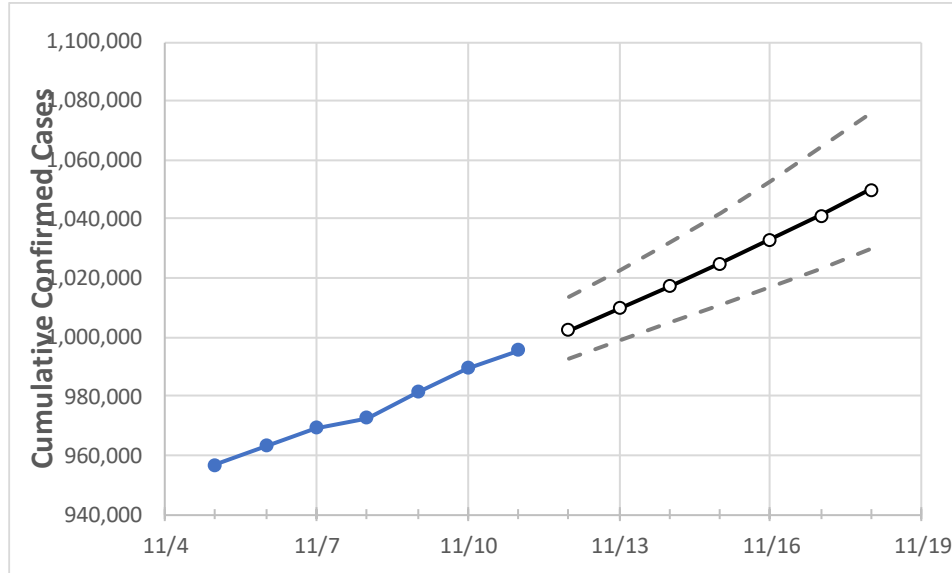
IEM's Modeling Lead

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:					
	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18	11/19
California	972,713	981,297	989,432	995,575	1,002,501	1,009,691	1,017,153	1,024,898	1,032,934	1,041,274	1,049,928	

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:						
	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18
Alameda	24,833	25,001	25,110	25,249	25,373	25,501	25,631	25,765	25,901	26,041	26,185
Contra Costa	19,943	20,031	20,193	20,326	20,454	20,586	20,723	20,864	21,010	21,161	21,317
Fresno	32,497	32,619	32,755	33,024	33,175	33,329	33,488	33,650	33,817	33,988	34,163
Kern	35,229	35,394	35,467	35,610	35,747	35,889	36,038	36,193	36,354	36,523	36,698
Los Angeles	321,801	323,625	325,876	327,964	330,322	332,785	335,360	338,051	340,862	343,800	346,871
Marin	7,243	7,254	7,270	7,284	7,298	7,312	7,326	7,341	7,356	7,372	7,388
Monterey	12,224	12,312	12,366	12,463	12,538	12,616	12,695	12,777	12,862	12,949	13,038
Orange	62,255	62,563	62,830	63,165	63,506	63,859	64,222	64,596	64,983	65,381	65,792
Placer	4,745	4,853	4,912	4,993	5,052	5,115	5,182	5,253	5,329	5,410	5,496
Riverside	71,153	71,620	72,341	72,341	72,623	72,914	73,213	73,520	73,837	74,163	74,499
Sacramento	27,773	28,059	28,237	28,721	28,995	29,283	29,584	29,901	30,232	30,580	30,945
San Bernardino	68,721	68,865	70,347	71,072	71,623	72,196	72,795	73,418	74,068	74,745	75,451
San Diego	59,682	60,570	61,053	61,085	61,258	61,426	61,590	61,750	61,905	62,056	62,204
San Francisco	12,980	13,081	13,139	13,210	13,303	13,401	13,503	13,610	13,723	13,841	13,965
San Joaquin	22,670	22,705	22,740	22,993	23,064	23,138	23,216	23,298	23,384	23,474	23,569
San Luis Obispo	4,668	4,698	4,794	4,846	4,879	4,913	4,949	4,987	5,027	5,069	5,113
San Mateo	11,874	11,937	12,049	12,127	12,205	12,286	12,370	12,458	12,550	12,645	12,745
Santa Barbara	10,157	10,180	10,230	10,260	10,286	10,313	10,339	10,367	10,394	10,422	10,450
Santa Clara	26,490	26,747	26,972	27,124	27,339	27,560	27,788	28,023	28,265	28,514	28,771
Santa Cruz	3,130	3,134	3,221	3,227	3,249	3,271	3,294	3,318	3,342	3,367	3,393
Solano	8,288	8,366	8,430	8,430	8,520	8,614	8,712	8,814	8,920	9,031	9,146
Sonoma	10,336	10,424	10,505	10,606	10,688	10,771	10,856	10,942	11,031	11,121	11,213
Ventura	15,364	15,504	15,568	15,625	15,735	15,851	15,971	16,097	16,229	16,366	16,509

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:											
	11/8	11/9	11/10	11/11	11/13				11/15				11/17			
Alameda	24,833	25,001	25,110	25,249	25,501	(5,100)	[1,224]	{612}	25,765	(5,153)	[1,237]	{618}	26,041	(5,208)	[1,250]	{625}
Contra Costa	19,943	20,031	20,193	20,326	20,586	(4,117)	[988]	{494}	20,864	(4,173)	[1,001]	{501}	21,161	(4,232)	[1,016]	{508}
Fresno	32,497	32,619	32,755	33,024	33,329	(6,666)	[1,600]	{800}	33,650	(6,730)	[1,615]	{808}	33,988	(6,798)	[1,631]	{816}
Kern	35,229	35,394	35,467	35,610	35,889	(7,178)	[1,723]	{861}	36,193	(7,239)	[1,737]	{869}	36,523	(7,305)	[1,753]	{877}
Los Angeles	321,801	323,625	325,876	327,964	332,785	(66,557)	[15,974]	{7,987}	338,051	(67,610)	[16,226]	{8,113}	343,800	(68,760)	[16,502]	{8,251}
Marin	7,243	7,254	7,270	7,284	7,312	(1,462)	[351]	{175}	7,341	(1,468)	[352]	{176}	7,372	(1,474)	[354]	{177}
Monterey	12,224	12,312	12,366	12,463	12,616	(2,523)	[606]	{303}	12,777	(2,555)	[613]	{307}	12,949	(2,590)	[622]	{311}
Orange	62,255	62,563	62,830	63,165	63,859	(12,772)	[3,065]	{1,533}	64,596	(12,919)	[3,101]	{1,550}	65,381	(13,076)	[3,138]	{1,569}
Placer	4,745	4,853	4,912	4,993	5,115	(1,023)	[246]	{123}	5,253	(1,051)	[252]	{126}	5,410	(1,082)	[260]	{130}
Riverside	71,153	71,620	72,341	72,341	72,914	(14,583)	[3,500]	{1,750}	73,520	(14,704)	[3,529]	{1,764}	74,163	(14,833)	[3,560]	{1,780}
Sacramento	27,773	28,059	28,237	28,721	29,283	(5,857)	[1,406]	{703}	29,901	(5,980)	[1,435]	{718}	30,580	(6,116)	[1,468]	{734}
San Bernardino	68,721	68,865	70,347	71,072	72,196	(14,439)	[3,465]	{1,733}	73,418	(14,684)	[3,524]	{1,762}	74,745	(14,949)	[3,588]	{1,794}
San Diego	59,682	60,570	61,053	61,085	61,426	(12,285)	[2,948]	{1,474}	61,750	(12,350)	[2,964]	{1,482}	62,056	(12,411)	[2,979]	{1,489}
San Francisco	12,980	13,081	13,139	13,210	13,401	(2,680)	[643]	{322}	13,610	(2,722)	[653]	{327}	13,841	(2,768)	[664]	{332}
San Joaquin	22,670	22,705	22,740	22,993	23,138	(4,628)	[1,111]	{555}	23,298	(4,660)	[1,118]	{559}	23,474	(4,695)	[1,127]	{563}
San Luis Obispo	4,668	4,698	4,794	4,846	4,913	(983)	[236]	{118}	4,987	(997)	[239]	{120}	5,069	(1,014)	[243]	{122}
San Mateo	11,874	11,937	12,049	12,127	12,286	(2,457)	[590]	{295}	12,458	(2,492)	[598]	{299}	12,645	(2,529)	[607]	{303}
Santa Barbara	10,157	10,180	10,230	10,260	10,313	(2,063)	[495]	{248}	10,367	(2,073)	[498]	{249}	10,422	(2,084)	[500]	{250}
Santa Clara	26,490	26,747	26,972	27,124	27,560	(5,512)	[1,323]	{661}	28,023	(5,605)	[1,345]	{673}	28,514	(5,703)	[1,369]	{684}
Santa Cruz	3,130	3,134	3,221	3,227	3,271	(654)	[157]	{79}	3,318	(664)	[159]	{80}	3,367	(673)	[162]	{81}
Solano	8,288	8,366	8,430	8,430	8,614	(1,723)	[413]	{207}	8,814	(1,763)	[423]	{212}	9,031	(1,806)	[433]	{217}
Sonoma	10,336	10,424	10,505	10,606	10,771	(2,154)	[517]	{258}	10,942	(2,188)	[525]	{263}	11,121	(2,224)	[534]	{267}
Ventura	15,364	15,504	15,568	15,625	15,851	(3,170)	[761]	{380}	16,097	(3,219)	[773]	{386}	16,366	(3,273)	[786]	{393}

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.