

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 6/26/20**

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 6/26/20 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.

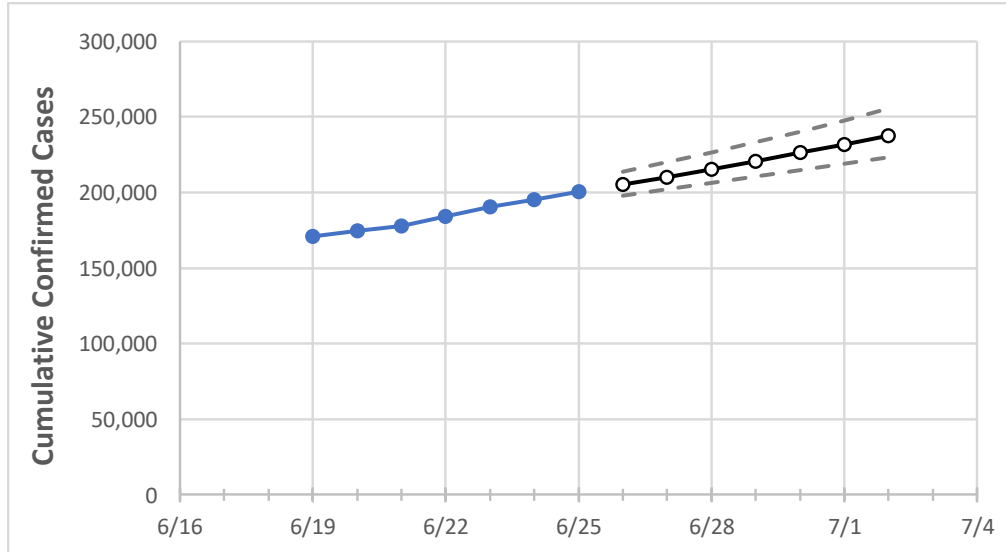
IEM's Modeling Lead

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:					
	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2
California	184,357	190,599	195,441	200,441	205,266	210,250	215,398	220,714	226,204	231,873	237,727

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:						
	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2
Alameda	5,007	5,140	5,275	5,382	5,479	5,578	5,680	5,786	5,894	6,006	6,121
Contra Costa	2,369	2,454	2,523	2,576	2,642	2,711	2,784	2,861	2,941	3,026	3,115
Fresno	3,485	3,672	3,892	4,053	4,210	4,377	4,555	4,744	4,945	5,158	5,386
Kern	3,965	4,049	4,108	4,182	4,265	4,350	4,436	4,523	4,612	4,702	4,793
Los Angeles	85,942	88,262	89,490	91,467	93,119	94,804	96,522	98,273	100,059	101,880	103,736
Marin	946	984	1,014	1,068	1,103	1,141	1,180	1,222	1,267	1,314	1,364
Monterey	1,291	1,341	1,397	1,416	1,468	1,523	1,583	1,647	1,715	1,789	1,867
Orange	10,595	10,737	11,016	11,511	11,791	12,083	12,388	12,705	13,036	13,380	13,740
Placer	519	534	556	579	603	628	655	684	714	747	782
Riverside	13,800	14,431	14,905	15,142	15,571	16,024	16,500	17,001	17,528	18,084	18,668
Sacramento	2,243	2,374	2,440	2,512	2,598	2,691	2,792	2,900	3,018	3,145	3,283
San Bernardino	9,361	10,010	10,407	10,769	11,110	11,472	11,857	12,266	12,700	13,162	13,652
San Diego	11,096	11,361	11,626	11,961	12,215	12,481	12,758	13,048	13,350	13,665	13,995
San Francisco	3,185	3,219	3,249	3,297	3,320	3,343	3,367	3,391	3,415	3,440	3,464
San Joaquin	2,400	2,560	2,742	2,884	3,042	3,213	3,398	3,598	3,816	4,051	4,306
San Luis Obispo	442	453	473	489	512	527	542	558	572	586	600
San Mateo	2,825	2,901	2,961	2,996	3,032	3,068	3,105	3,143	3,182	3,221	3,261
Santa Barbara	2,446	2,509	2,590	2,631	2,697	2,767	2,843	2,925	3,013	3,108	3,210
Santa Clara	3,606	3,727	3,832	3,888	3,966	4,050	4,139	4,234	4,335	4,443	4,557
Santa Cruz	309	322	330	337	345	353	362	371	382	393	404
Solano	933	1,020	1,064	1,094	1,135	1,170	1,208	1,243	1,284	1,325	1,360
Sonoma	885	935	956	974	996	1,019	1,043	1,068	1,095	1,123	1,153
Ventura	2,030	2,161	2,260	2,287	2,357	2,431	2,509	2,591	2,676	2,766	2,861

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:											
	6/22	6/23	6/24	6/25	6/27				6/29				7/1			
Alameda	5,007	5,140	5,275	5,382	5,578	(1,116)	[268]	{134}	5,786	(1,157)	[278]	{139}	6,006	(1,201)	[288]	{144}
Contra Costa	2,369	2,454	2,523	2,576	2,711	(542)	[130]	{65}	2,861	(572)	[137]	{69}	3,026	(605)	[145]	{73}
Fresno	3,485	3,672	3,892	4,053	4,377	(875)	[210]	{105}	4,744	(949)	[228]	{114}	5,158	(1,032)	[248]	{124}
Kern	3,965	4,049	4,108	4,182	4,350	(870)	[209]	{104}	4,523	(905)	[217]	{109}	4,702	(940)	[226]	{113}
Los Angeles	85,942	88,262	89,490	91,467	94,804	(18,961)	[4,551]	{2,275}	98,273	(19,655)	[4,717]	{2,359}	101,880	(20,376)	[4,890]	{2,445}
Marin	946	984	1,014	1,068	1,141	(228)	[55]	{27}	1,222	(244)	[59]	{29}	1,314	(263)	[63]	{32}
Monterey	1,291	1,341	1,397	1,416	1,523	(305)	[73]	{37}	1,647	(329)	[79]	{40}	1,789	(358)	[86]	{43}
Orange	10,595	10,737	11,016	11,511	12,083	(2,417)	[580]	{290}	12,705	(2,541)	[610]	{305}	13,380	(2,676)	[642]	{321}
Placer	519	534	556	579	628	(126)	[30]	{15}	684	(137)	[33]	{16}	747	(149)	[36]	{18}
Riverside	13,800	14,431	14,905	15,142	16,024	(3,205)	[769]	{385}	17,001	(3,400)	[816]	{408}	18,084	(3,617)	[868]	{434}
Sacramento	2,243	2,374	2,440	2,512	2,691	(538)	[129]	{65}	2,900	(580)	[139]	{70}	3,145	(629)	[151]	{75}
San Bernardino	9,361	10,010	10,407	10,769	11,472	(2,294)	[551]	{275}	12,266	(2,453)	[589]	{294}	13,162	(2,632)	[632]	{316}
San Diego	11,096	11,361	11,626	11,961	12,481	(2,496)	[599]	{300}	13,048	(2,610)	[626]	{313}	13,665	(2,733)	[656]	{328}
San Francisco	3,185	3,219	3,249	3,297	3,343	(669)	[160]	{80}	3,391	(678)	[163]	{81}	3,440	(688)	[165]	{83}
San Joaquin	2,400	2,560	2,742	2,884	3,213	(643)	[154]	{77}	3,598	(720)	[173]	{86}	4,051	(810)	[194]	{97}
San Luis Obispo	442	453	473	489	527	(105)	[25]	{13}	558	(112)	[27]	{13}	586	(117)	[28]	{14}
San Mateo	2,825	2,901	2,961	2,996	3,068	(614)	[147]	{74}	3,143	(629)	[151]	{75}	3,221	(644)	[155]	{77}
Santa Barbara	2,446	2,509	2,590	2,631	2,767	(553)	[133]	{66}	2,925	(585)	[140]	{70}	3,108	(622)	[149]	{75}
Santa Clara	3,606	3,727	3,832	3,888	4,050	(810)	[194]	{97}	4,234	(847)	[203]	{102}	4,443	(889)	[213]	{107}
Santa Cruz	309	322	330	337	353	(71)	[17]	{8}	371	(74)	[18]	{9}	393	(79)	[19]	{9}
Solano	933	1,020	1,064	1,094	1,170	(234)	[56]	{28}	1,243	(249)	[60]	{30}	1,325	(265)	[64]	{32}
Sonoma	885	935	956	974	1,019	(204)	[49]	{24}	1,068	(214)	[51]	{26}	1,123	(225)	[54]	{27}
Ventura	2,030	2,161	2,260	2,287	2,431	(486)	[117]	{58}	2,591	(518)	[124]	{62}	2,766	(553)	[133]	{66}

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.