

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

Date: 6/25/20

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 6/25/20 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.

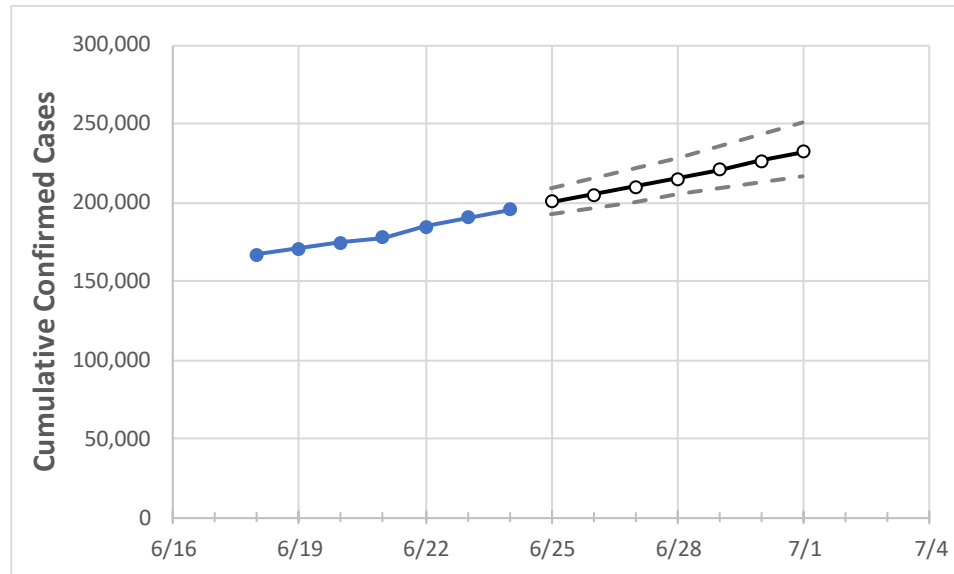
IEM's Modeling Lead

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:						
	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1
California	177,691	184,357	190,599	195,441	200,160	205,036	210,072	215,275	220,650	226,202	231,937

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:						
	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1
Alameda	4,906	5,007	5,140	5,275	5,367	5,462	5,559	5,659	5,762	5,867	5,975
Contra Costa	2,294	2,369	2,454	2,523	2,589	2,659	2,733	2,810	2,893	2,979	3,071
Fresno	3,365	3,485	3,672	3,892	4,041	4,199	4,367	4,545	4,735	4,937	5,151
Kern	3,890	3,965	4,049	4,108	4,189	4,270	4,354	4,438	4,524	4,611	4,699
Los Angeles	83,397	85,942	88,262	89,490	91,115	92,773	94,462	96,185	97,942	99,733	101,559
Marin	913	946	984	1,014	1,046	1,081	1,117	1,155	1,196	1,238	1,283
Monterey	1,246	1,291	1,341	1,397	1,443	1,492	1,542	1,585	1,630	1,677	1,724
Orange	10,422	10,595	10,737	11,016	11,266	11,524	11,792	12,069	12,355	12,652	12,959
Placer	502	519	534	556	577	592	609	625	640	656	672
Riverside	13,459	13,800	14,431	14,905	15,338	15,795	16,279	16,790	17,330	17,900	18,503
Sacramento	2,154	2,243	2,374	2,440	2,518	2,603	2,694	2,793	2,899	3,014	3,138
San Bernardino	9,156	9,361	10,010	10,407	10,754	11,124	11,518	11,937	12,385	12,861	13,368
San Diego	10,794	11,096	11,361	11,626	11,854	12,090	12,335	12,590	12,854	13,128	13,413
San Francisco	3,122	3,185	3,219	3,249	3,271	3,293	3,315	3,337	3,359	3,382	3,404
San Joaquin	2,259	2,400	2,560	2,742	2,885	3,039	3,206	3,387	3,582	3,794	4,023
San Luis Obispo	429	442	453	473	494	509	525	541	557	571	587
San Mateo	2,790	2,825	2,901	2,961	2,994	3,048	3,101	3,152	3,201	3,250	3,302
Santa Barbara	2,404	2,446	2,509	2,590	2,658	2,731	2,811	2,897	2,991	3,092	3,202
Santa Clara	3,547	3,606	3,727	3,832	3,902	3,990	4,072	4,162	4,247	4,325	4,409
Santa Cruz	296	309	322	330	337	345	353	361	371	380	391
Solano	909	933	1,020	1,064	1,102	1,144	1,190	1,240	1,295	1,356	1,422
Sonoma	853	885	935	956	977	999	1,023	1,048	1,074	1,101	1,131
Ventura	1,933	2,030	2,161	2,260	2,335	2,415	2,500	2,589	2,685	2,786	2,893

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:											
	6/21	6/22	6/23	6/24	6/26				6/28				6/30			
Alameda	4,906	5,007	5,140	5,275	5,462	(1,092)	[262]	{131}	5,659	(1,132)	[272]	{136}	5,867	(1,173)	[282]	{141}
Contra Costa	2,294	2,369	2,454	2,523	2,659	(532)	[128]	{64}	2,810	(562)	[135]	{67}	2,979	(596)	[143]	{72}
Fresno	3,365	3,485	3,672	3,892	4,199	(840)	[202]	{101}	4,545	(909)	[218]	{109}	4,937	(987)	[237]	{118}
Kern	3,890	3,965	4,049	4,108	4,270	(854)	[205]	{102}	4,438	(888)	[213]	{107}	4,611	(922)	[221]	{111}
Los Angeles	83,397	85,942	88,262	89,490	12,773	(18,555)	[4,453]	{2,227}	16,185	(19,237)	[4,617]	{2,308}	19,733	(19,947)	[4,787]	{2,394}
Marin	913	946	984	1,014	1,081	(216)	[52]	{26}	1,155	(231)	[55]	{28}	1,238	(248)	[59]	{30}
Monterey	1,246	1,291	1,341	1,397	1,492	(298)	[72]	{36}	1,585	(317)	[76]	{38}	1,677	(335)	[80]	{40}
Orange	10,422	10,595	10,737	11,016	11,524	(2,305)	[553]	{277}	12,069	(2,414)	[579]	{290}	12,652	(2,530)	[607]	{304}
Placer	502	519	534	556	592	(118)	[28]	{14}	625	(125)	[30]	{15}	656	(131)	[31]	{16}
Riverside	13,459	13,800	14,431	14,905	15,795	(3,159)	[758]	{379}	16,790	(3,358)	[806]	{403}	17,900	(3,580)	[859]	{430}
Sacramento	2,154	2,243	2,374	2,440	2,603	(521)	[125]	{62}	2,793	(559)	[134]	{67}	3,014	(603)	[145]	{72}
San Bernardino	9,156	9,361	10,010	10,407	11,124	(2,225)	[534]	{267}	11,937	(2,387)	[573]	{286}	12,861	(2,572)	[617]	{309}
San Diego	10,794	11,096	11,361	11,626	12,090	(2,418)	[580]	{290}	12,590	(2,518)	[604]	{302}	13,128	(2,626)	[630]	{315}
San Francisco	3,122	3,185	3,219	3,249	3,293	(659)	[158]	{79}	3,337	(667)	[160]	{80}	3,382	(676)	[162]	{81}
San Joaquin	2,259	2,400	2,560	2,742	3,039	(608)	[146]	{73}	3,387	(677)	[163]	{81}	3,794	(759)	[182]	{91}
San Luis Obispo	429	442	453	473	509	(102)	[24]	{12}	541	(108)	[26]	{13}	571	(114)	[27]	{14}
San Mateo	2,790	2,825	2,901	2,961	3,048	(610)	[146]	{73}	3,152	(630)	[151]	{76}	3,250	(650)	[156]	{78}
Santa Barbara	2,404	2,446	2,509	2,590	2,731	(546)	[131]	{66}	2,897	(579)	[139]	{70}	3,092	(618)	[148]	{74}
Santa Clara	3,547	3,606	3,727	3,832	3,990	(798)	[192]	{96}	4,162	(832)	[200]	{100}	4,325	(865)	[208]	{104}
Santa Cruz	296	309	322	330	345	(69)	[17]	{8}	361	(72)	[17]	{9}	380	(76)	[18]	{9}
Solano	909	933	1,020	1,064	1,144	(229)	[55]	{27}	1,240	(248)	[60]	{30}	1,356	(271)	[65]	{33}
Sonoma	853	885	935	956	999	(200)	[48]	{24}	1,048	(210)	[50]	{25}	1,101	(220)	[53]	{26}
Ventura	1,933	2,030	2,161	2,260	2,415	(483)	[116]	{58}	2,589	(518)	[124]	{62}	2,786	(557)	[134]	{67}

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.