

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

Date: 7/1/20

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 7/1/20 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.

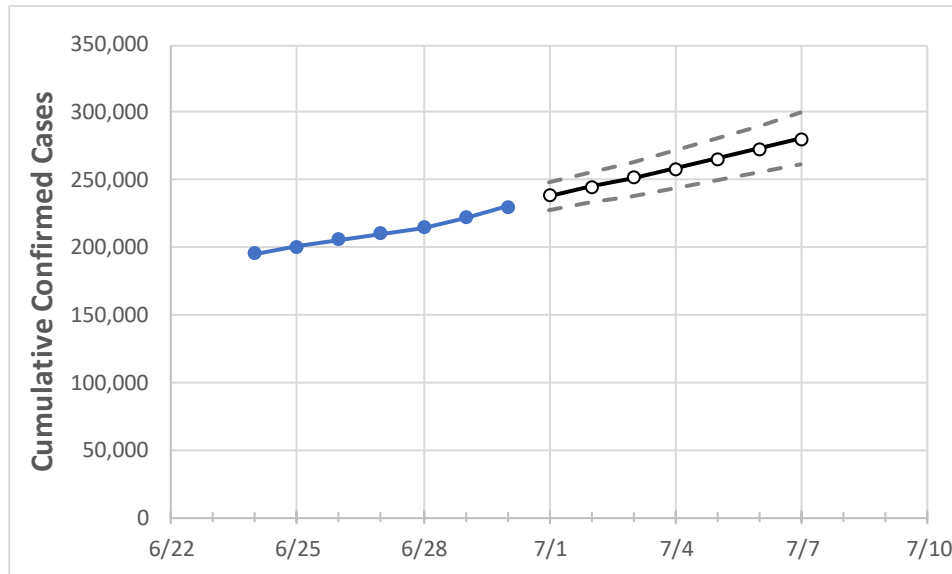
IEM's Modeling Lead

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:							
	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	
California	209,956	214,507	222,053	230,360	238,477	244,827	251,416	258,255	265,353	272,718	280,361	

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:						
	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7
Alameda	5,608	5,670	5,762	5,964	6,081	6,202	6,327	6,456	6,589	6,725	6,867
Contra Costa	2,688	2,802	2,971	3,132	3,220	3,313	3,412	3,517	3,628	3,745	3,869
Fresno	4,474	4,478	4,811	5,008	5,159	5,316	5,480	5,649	5,826	6,009	6,199
Kern	4,340	4,444	4,548	4,655	4,746	4,839	4,933	5,029	5,127	5,227	5,328
Los Angeles	95,371	97,894	100,772	103,529	105,797	108,138	110,557	113,054	115,633	118,296	121,046
Marin	1,133	1,166	1,195	1,207	1,243	1,281	1,320	1,361	1,404	1,448	1,494
Monterey	1,489	1,548	1,605	1,642	1,696	1,753	1,813	1,877	1,944	2,015	2,090
Orange	12,462	12,608	13,064	13,843	14,253	14,685	15,141	15,621	16,128	16,663	17,227
Placer	611	627	643	684	711	733	757	778	802	823	845
Riverside	15,876	16,108	16,634	17,296	17,776	18,277	18,801	19,348	19,920	20,517	21,142
Sacramento	2,779	2,891	3,004	3,223	3,369	3,527	3,700	3,887	4,091	4,313	4,555
San Bernardino	11,396	11,501	11,797	12,550	12,910	13,289	13,687	14,105	14,544	15,006	15,491
San Diego	12,837	13,334	13,832	14,149	14,536	14,946	15,379	15,837	16,321	16,833	17,374
San Francisco	3,468	3,512	3,561	3,603	3,643	3,686	3,730	3,775	3,823	3,873	3,925
San Joaquin	3,093	3,192	3,291	3,856	4,267	4,458	4,623	4,789	4,954	5,147	5,340
San Luis Obispo	528	547	567	611	638	663	685	707	732	753	775
San Mateo	3,083	3,112	3,141	3,232	3,276	3,321	3,367	3,415	3,464	3,514	3,566
Santa Barbara	2,758	2,804	2,850	2,896	2,970	3,049	3,133	3,223	3,318	3,419	3,527
Santa Clara	4,073	4,162	4,265	4,370	4,481	4,599	4,725	4,860	5,003	5,156	5,319
Santa Cruz	349	359	369	379	389	401	413	425	439	454	469
Solano	1,121	1,123	1,126	1,288	1,313	1,340	1,367	1,395	1,424	1,454	1,485
Sonoma	1,092	1,105	1,118	1,136	1,164	1,194	1,225	1,257	1,292	1,328	1,366
Ventura	2,471	2,605	2,740	2,740	2,849	2,964	3,087	3,218	3,357	3,505	3,662

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:											
	6/27	6/28	6/29	6/30	7/2				7/4				7/6			
Alameda	5,608	5,670	5,762	5,964	6,202	(1,240)	[298]	{149}	6,456	(1,291)	[310]	{155}	6,725	(1,345)	[323]	{161}
Contra Costa	2,688	2,802	2,971	3,132	3,313	(663)	[159]	{80}	3,517	(703)	[169]	{84}	3,745	(749)	[180]	{90}
Fresno	4,474	4,478	4,811	5,008	5,316	(1,063)	[255]	{128}	5,649	(1,130)	[271]	{136}	6,009	(1,202)	[288]	{144}
Kern	4,340	4,444	4,548	4,655	4,839	(968)	[232]	{116}	5,029	(1,006)	[241]	{121}	5,227	(1,045)	[251]	{125}
Los Angeles	95,371	97,894	100,772	103,529	108,138	(21,628)	[5,191]	{2,591}	113,054	(22,611)	[5,427]	{2,711}	118,296	(23,659)	[5,678]	{2,835}
Marin	1,133	1,166	1,195	1,207	1,281	(256)	[61]	{31}	1,361	(272)	[65]	{33}	1,448	(290)	[69]	{35}
Monterey	1,489	1,548	1,605	1,642	1,753	(351)	[84]	{42}	1,877	(375)	[90]	{45}	2,015	(403)	[97]	{48}
Orange	12,462	12,608	13,064	13,843	14,685	(2,937)	[705]	{352}	15,621	(3,124)	[750]	{375}	16,663	(3,333)	[800]	{400}
Placer	611	627	643	684	733	(147)	[35]	{18}	778	(156)	[37]	{19}	823	(165)	[40]	{20}
Riverside	15,876	16,108	16,634	17,296	18,277	(3,655)	[877]	{439}	19,348	(3,870)	[929]	{464}	20,517	(4,103)	[985]	{492}
Sacramento	2,779	2,891	3,004	3,223	3,527	(705)	[169]	{85}	3,887	(777)	[187]	{93}	4,313	(863)	[207]	{104}
San Bernardino	11,396	11,501	11,797	12,550	13,289	(2,658)	[638]	{319}	14,105	(2,821)	[677]	{339}	15,006	(3,001)	[720]	{360}
San Diego	12,837	13,334	13,832	14,149	14,946	(2,989)	[717]	{359}	15,837	(3,167)	[760]	{380}	16,833	(3,367)	[808]	{404}
San Francisco	3,468	3,512	3,561	3,603	3,686	(737)	[177]	{88}	3,775	(755)	[181]	{91}	3,873	(775)	[186]	{93}
San Joaquin	3,093	3,192	3,291	3,856	4,458	(892)	[214]	{107}	4,789	(958)	[230]	{115}	5,147	(1,029)	[247]	{124}
San Luis Obispo	528	547	567	611	663	(133)	[32]	{16}	707	(141)	[34]	{17}	753	(151)	[36]	{18}
San Mateo	3,083	3,112	3,141	3,232	3,321	(664)	[159]	{80}	3,415	(683)	[164]	{82}	3,514	(703)	[169]	{84}
Santa Barbara	2,758	2,804	2,850	2,896	3,049	(610)	[146]	{73}	3,223	(645)	[155]	{77}	3,419	(684)	[164]	{82}
Santa Clara	4,073	4,162	4,265	4,370	4,599	(920)	[221]	{110}	4,860	(972)	[233]	{117}	5,156	(1,031)	[247]	{124}
Santa Cruz	349	359	369	379	401	(80)	[19]	{10}	425	(85)	[20]	{10}	454	(91)	[22]	{11}
Solano	1,121	1,123	1,126	1,288	1,340	(268)	[64]	{32}	1,395	(279)	[67]	{33}	1,454	(291)	[70]	{35}
Sonoma	1,092	1,105	1,118	1,136	1,194	(239)	[57]	{29}	1,257	(251)	[60]	{30}	1,328	(266)	[64]	{32}
Ventura	2,471	2,605	2,740	2,740	2,964	(593)	[142]	{71}	3,218	(644)	[154]	{77}	3,505	(701)	[168]	{84}

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.