

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

Date: 8/18/20

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 8/18/20 1 p.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.

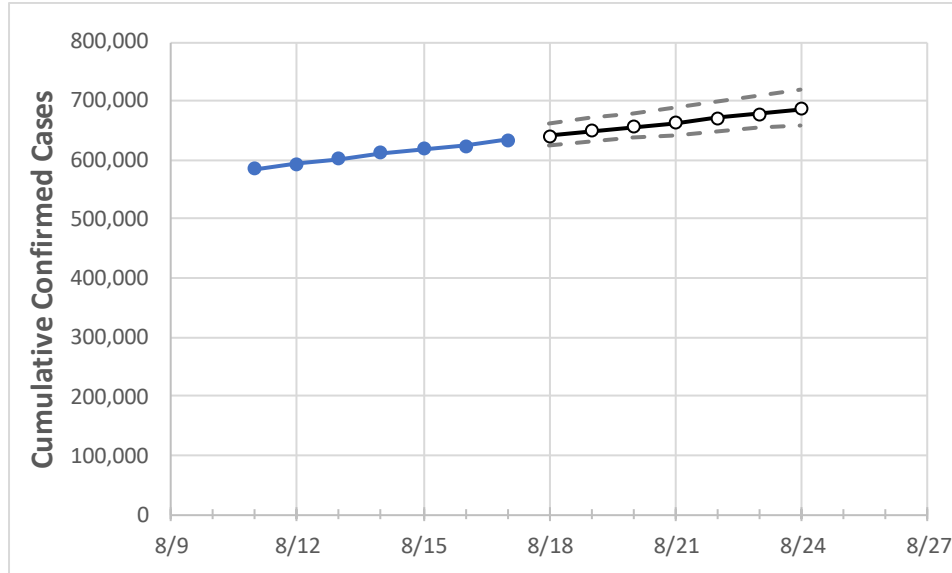
IEM's Modeling Lead

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:							
	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	
California	612,939	619,577	624,102	634,066	641,483	648,887	656,279	663,658	671,024	678,377	685,718	

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:						
	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24
Alameda	14,558	14,841	15,123	15,130	15,282	15,435	15,588	15,742	15,896	16,050	16,205
Contra Costa	10,756	11,013	11,228	11,408	11,672	11,946	12,229	12,522	12,826	13,140	13,466
Fresno	19,157	19,900	20,455	21,010	21,391	21,779	22,176	22,580	22,993	23,414	23,843
Kern	25,888	26,266	26,570	26,788	27,099	27,405	27,707	28,005	28,299	28,588	28,874
Los Angeles	218,693	220,762	221,950	223,131	224,840	226,525	228,187	229,825	231,440	233,034	234,604
Marin	5,707	5,734	5,761	5,788	5,822	5,855	5,888	5,921	5,953	5,986	6,017
Monterey	5,890	6,109	6,329	6,548	6,664	6,783	6,906	7,033	7,163	7,297	7,436
Orange	42,854	43,367	43,709	43,925	44,235	44,544	44,851	45,156	45,460	45,762	46,062
Placer	2,543	2,582	2,600	2,625	2,666	2,708	2,751	2,794	2,838	2,883	2,928
Riverside	45,662	46,271	46,881	47,490	48,148	48,819	49,503	50,201	50,914	51,640	52,382
Sacramento	13,615	13,852	14,089	14,326	14,621	14,928	15,247	15,578	15,922	16,279	16,649
San Bernardino	39,374	40,338	41,124	41,564	42,067	42,577	43,094	43,617	44,148	44,685	45,229
San Diego	34,065	34,344	34,678	34,960	35,224	35,483	35,739	35,991	36,239	36,483	36,723
San Francisco	8,053	8,157	8,292	8,346	8,438	8,530	8,624	8,718	8,813	8,909	9,006
San Joaquin	14,651	14,770	14,889	15,008	15,166	15,325	15,484	15,645	15,807	15,969	16,132
San Luis Obispo	2,439	2,480	2,521	2,562	2,602	2,642	2,683	2,724	2,766	2,809	2,853
San Mateo	6,803	6,952	7,051	7,150	7,249	7,353	7,459	7,570	7,684	7,802	7,924
Santa Barbara	7,274	7,334	7,394	7,454	7,506	7,558	7,610	7,661	7,711	7,761	7,811
Santa Clara	13,856	14,207	14,429	14,636	14,905	15,180	15,462	15,750	16,045	16,346	16,655
Santa Cruz	1,371	1,420	1,454	1,454	1,469	1,485	1,501	1,517	1,533	1,549	1,565
Solano	4,596	4,653	4,710	4,767	4,838	4,909	4,981	5,054	5,127	5,201	5,276
Sonoma	4,063	4,157	4,293	4,377	4,467	4,559	4,655	4,755	4,858	4,964	5,075
Ventura	9,090	9,159	9,228	9,297	9,381	9,465	9,548	9,631	9,714	9,796	9,878

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:											
	8/14	8/15	8/16	8/17	8/19				8/21				8/23			
Alameda	14,558	14,841	15,123	15,130	15,435	(3,087)	[741]	{370}	15,742	(3,148)	[756]	{378}	16,050	(3,210)	[770]	{385}
Contra Costa	10,756	11,013	11,228	11,408	11,946	(2,389)	[573]	{287}	12,522	(2,504)	[601]	{301}	13,140	(2,628)	[631]	{315}
Fresno	19,157	19,900	20,455	21,010	21,779	(4,356)	[1,045]	{523}	22,580	(4,516)	[1,084]	{542}	23,414	(4,683)	[1,124]	{562}
Kern	25,888	26,266	26,570	26,788	27,405	(5,481)	[1,315]	{658}	28,005	(5,601)	[1,344]	{672}	28,588	(5,718)	[1,372]	{686}
Los Angeles	218,693	220,762	221,950	223,131	226,525	(45,305)	[10,873]	{5,437}	229,825	(45,965)	[11,032]	{5,516}	233,034	(46,607)	[11,186]	{5,593}
Marin	5,707	5,734	5,761	5,788	5,855	(1,171)	[281]	{141}	5,921	(1,184)	[284]	{142}	5,986	(1,197)	[287]	{144}
Monterey	5,890	6,109	6,329	6,548	6,783	(1,357)	[326]	{163}	7,033	(1,407)	[338]	{169}	7,297	(1,459)	[350]	{175}
Orange	42,854	43,367	43,709	43,925	44,544	(8,909)	[2,138]	{1,069}	45,156	(9,031)	[2,167]	{1,084}	45,762	(9,152)	[2,197]	{1,098}
Placer	2,543	2,582	2,600	2,625	2,708	(542)	[130]	{65}	2,794	(559)	[134]	{67}	2,883	(577)	[138]	{69}
Riverside	45,662	46,271	46,881	47,490	48,819	(9,764)	[2,343]	{1,172}	50,201	(10,040)	[2,410]	{1,205}	51,640	(10,328)	[2,479]	{1,239}
Sacramento	13,615	13,852	14,089	14,326	14,928	(2,986)	[717]	{358}	15,578	(3,116)	[748]	{374}	16,279	(3,256)	[781]	{391}
San Bernardino	39,374	40,338	41,124	41,564	42,577	(8,515)	[2,044]	{1,022}	43,617	(8,723)	[2,094]	{1,047}	44,685	(8,937)	[2,145]	{1,072}
San Diego	34,065	34,344	34,678	34,960	35,483	(7,097)	[1,703]	{852}	35,991	(7,198)	[1,728]	{864}	36,483	(7,297)	[1,751]	{876}
San Francisco	8,053	8,157	8,292	8,346	8,530	(1,706)	[409]	{205}	8,718	(1,744)	[418]	{209}	8,909	(1,782)	[428]	{214}
San Joaquin	14,651	14,770	14,889	15,008	15,325	(3,065)	[736]	{368}	15,645	(3,129)	[751]	{375}	15,969	(3,194)	[767]	{383}
San Luis Obispo	2,439	2,480	2,521	2,562	2,642	(528)	[127]	{63}	2,724	(545)	[131]	{65}	2,809	(562)	[135]	{67}
San Mateo	6,803	6,952	7,051	7,150	7,353	(1,471)	[353]	{176}	7,570	(1,514)	[363]	{182}	7,802	(1,560)	[374]	{187}
Santa Barbara	7,274	7,334	7,394	7,454	7,558	(1,512)	[363]	{181}	7,661	(1,532)	[368]	{184}	7,761	(1,552)	[373]	{186}
Santa Clara	13,856	14,207	14,429	14,636	15,180	(3,036)	[729]	{364}	15,750	(3,150)	[756]	{378}	16,346	(3,269)	[785]	{392}
Santa Cruz	1,371	1,420	1,454	1,454	1,485	(297)	[71]	{36}	1,517	(303)	[73]	{36}	1,549	(310)	[74]	{37}
Solano	4,596	4,653	4,710	4,767	4,909	(982)	[236]	{118}	5,054	(1,011)	[243]	{121}	5,201	(1,040)	[250]	{125}
Sonoma	4,063	4,157	4,293	4,377	4,559	(912)	[219]	{109}	4,755	(951)	[228]	{114}	4,964	(993)	[238]	{119}
Ventura	9,090	9,159	9,228	9,297	9,465	(1,893)	[454]	{227}	9,631	(1,926)	[462]	{231}	9,796	(1,959)	[470]	{235}

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.