

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

Date: 8/24/20

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 8/24/20 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.

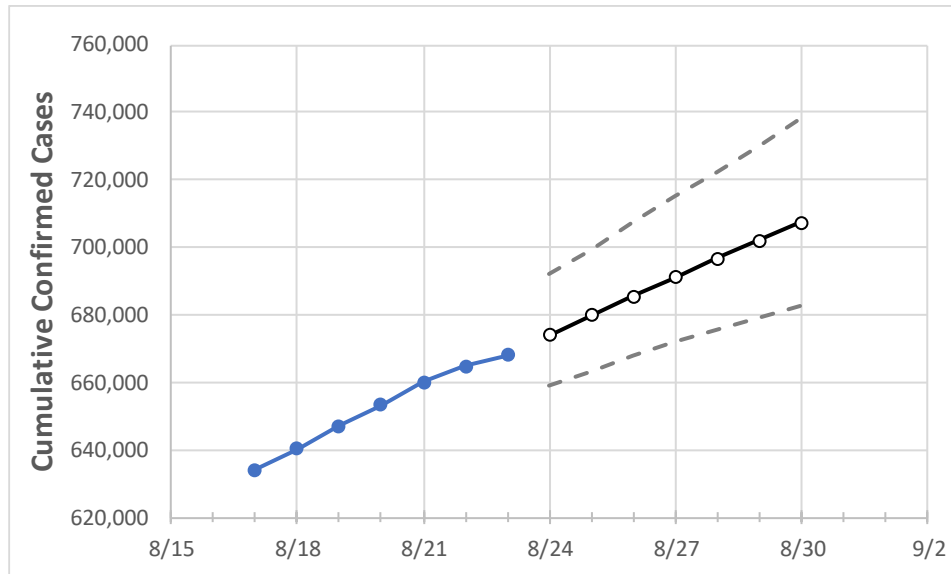
IEM's Modeling Lead

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:						
	8/20	8/21	8/22	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30
California	653,129	660,005	664,745	668,073	673,998	679,810	685,515	691,113	696,607	701,998	707,290

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:						
	8/20	8/21	8/22	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30
Alameda	16,184	16,469	16,693	16,723	16,874	17,026	17,179	17,331	17,485	17,638	17,793
Contra Costa	12,046	12,362	12,527	12,663	12,903	13,147	13,395	13,648	13,905	14,167	14,434
Fresno	22,167	22,535	22,840	22,840	23,252	23,673	24,103	24,542	24,990	25,447	25,914
Kern	27,378	27,658	27,915	28,140	28,339	28,532	28,717	28,896	29,068	29,233	29,393
Los Angeles	227,346	229,054	230,662	231,695	232,853	233,974	235,058	236,106	237,120	238,100	239,048
Marin	5,852	5,879	5,879	5,879	5,906	5,933	5,960	5,986	6,012	6,037	6,062
Monterey	6,865	7,266	7,266	7,266	7,450	7,644	7,848	8,062	8,287	8,523	8,771
Orange	44,936	45,308	45,801	45,954	46,265	46,573	46,878	47,179	47,478	47,773	48,065
Placer	2,689	2,705	2,740	2,777	2,800	2,823	2,845	2,867	2,889	2,909	2,930
Riverside	48,956	49,482	49,482	49,482	50,052	50,627	51,205	51,788	52,374	52,965	53,560
Sacramento	14,984	15,246	15,246	15,246	15,544	15,850	16,162	16,483	16,810	17,146	17,489
San Bernardino	43,469	43,943	44,603	45,035	45,590	46,153	46,724	47,305	47,894	48,492	49,099
San Diego	35,608	35,912	36,203	36,540	36,766	36,989	37,208	37,423	37,635	37,844	38,050
San Francisco	8,611	8,702	8,791	8,871	8,947	9,023	9,099	9,174	9,249	9,323	9,397
San Joaquin	15,492	15,622	15,622	15,622	15,789	15,956	16,124	16,292	16,461	16,631	16,801
San Luis Obispo	2,613	2,665	2,665	2,665	2,690	2,715	2,740	2,764	2,788	2,812	2,835
San Mateo	7,382	7,472	7,535	7,535	7,632	7,731	7,831	7,933	8,035	8,139	8,245
Santa Barbara	7,578	7,653	7,653	7,653	7,697	7,740	7,783	7,825	7,867	7,909	7,949
Santa Clara	15,258	15,496	15,688	16,011	16,264	16,520	16,778	17,039	17,303	17,569	17,838
Santa Cruz	1,569	1,605	1,617	1,617	1,645	1,673	1,703	1,734	1,767	1,800	1,836
Solano	5,006	5,048	5,048	5,048	5,109	5,170	5,231	5,292	5,353	5,414	5,474
Sonoma	4,779	4,863	4,942	5,067	5,170	5,276	5,386	5,499	5,617	5,738	5,864
Ventura	9,557	9,695	9,695	9,695	9,770	9,845	9,918	9,990	10,061	10,132	10,201

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:											
	8/20	8/21	8/22	8/23	8/25				8/27				8/29			
Alameda	16,184	16,469	16,693	16,723	17,026	(3,405)	[817]	{409}	17,331	(3,466)	[832]	{416}	17,638	(3,528)	[847]	{423}
Contra Costa	12,046	12,362	12,527	12,663	13,147	(2,629)	[631]	{316}	13,648	(2,730)	[655]	{328}	14,167	(2,833)	[680]	{340}
Fresno	22,167	22,535	22,840	22,840	23,673	(4,735)	[1,136]	{568}	24,542	(4,908)	[1,178]	{589}	25,447	(5,089)	[1,221]	{611}
Kern	27,378	27,658	27,915	28,140	28,532	(5,706)	[1,370]	{685}	28,896	(5,779)	[1,387]	{693}	29,233	(5,847)	[1,403]	{702}
Los Angeles	227,346	229,054	230,662	231,695	233,974	(46,795)	[11,231]	{5,615}	236,106	(47,221)	[11,333]	{5,667}	238,100	(47,620)	[11,429]	{5,714}
Marin	5,852	5,879	5,879	5,879	5,933	(1,187)	[285]	{142}	5,986	(1,197)	[287]	{144}	6,037	(1,207)	[290]	{145}
Monterey	8,865	7,266	7,266	7,266	7,644	(1,529)	[367]	{183}	8,062	(1,612)	[387]	{193}	8,523	(1,705)	[409]	{205}
Orange	44,936	45,308	45,801	45,954	46,573	(9,315)	[2,235]	{1,118}	47,179	(9,436)	[2,265]	{1,132}	47,773	(9,555)	[2,293]	{1,147}
Placer	2,689	2,705	2,740	2,777	2,823	(565)	[136]	{68}	2,867	(573)	[138]	{69}	2,909	(582)	[140]	{70}
Riverside	48,956	49,482	49,482	49,482	50,627	(10,125)	[2,430]	{1,215}	51,788	(10,358)	[2,486]	{1,243}	52,965	(10,593)	[2,542]	{1,271}
Sacramento	14,984	15,246	15,246	15,246	15,850	(3,170)	[761]	{380}	16,483	(3,297)	[791]	{396}	17,146	(3,429)	[823]	{411}
San Bernardino	43,469	43,943	44,603	45,035	46,153	(9,231)	[2,215]	{1,108}	47,305	(9,461)	[2,271]	{1,135}	48,492	(9,698)	[2,328]	{1,164}
San Diego	35,608	35,912	36,203	36,540	36,989	(7,398)	[1,775]	{888}	37,423	(7,485)	[1,796]	{898}	37,844	(7,569)	[1,817]	{908}
San Francisco	8,611	8,702	8,791	8,871	9,023	(1,805)	[433]	{217}	9,174	(1,835)	[440]	{220}	9,323	(1,865)	[447]	{224}
San Joaquin	15,492	15,622	15,622	15,622	15,956	(3,191)	[766]	{383}	16,292	(3,258)	[782]	{391}	16,631	(3,326)	[798]	{399}
San Luis Obispo	2,613	2,665	2,665	2,665	2,715	(543)	[130]	{65}	2,764	(553)	[133]	{66}	2,812	(562)	[135]	{67}
San Mateo	7,382	7,472	7,535	7,535	7,731	(1,546)	[371]	{186}	7,933	(1,587)	[381]	{190}	8,139	(1,628)	[391]	{195}
Santa Barbara	7,578	7,653	7,653	7,653	7,740	(1,548)	[372]	{186}	7,825	(1,565)	[376]	{188}	7,909	(1,582)	[380]	{190}
Santa Clara	15,258	15,496	15,688	16,011	16,520	(3,304)	[793]	{396}	17,039	(3,408)	[818]	{409}	17,569	(3,514)	[843]	{422}
Santa Cruz	1,569	1,605	1,617	1,617	1,673	(335)	[80]	{40}	1,734	(347)	[83]	{42}	1,800	(360)	[86]	{43}
Solano	5,006	5,048	5,048	5,048	5,170	(1,034)	[248]	{124}	5,292	(1,058)	[254]	{127}	5,414	(1,083)	[260]	{130}
Sonoma	4,779	4,863	4,942	5,067	5,276	(1,055)	[253]	{127}	5,499	(1,100)	[264]	{132}	5,738	(1,148)	[275]	{138}
Ventura	9,557	9,695	9,695	9,695	9,845	(1,969)	[473]	{236}	9,990	(1,998)	[480]	{240}	10,132	(2,026)	[486]	{243}

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.