

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

Date: 8/5/20

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 8/5/20 12 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.

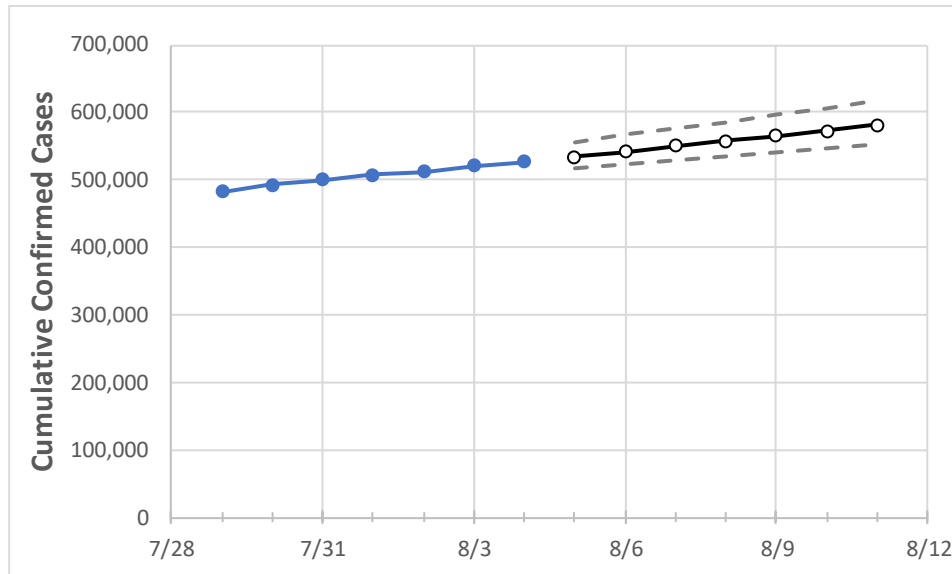
IEM's Modeling Lead

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:							
	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12
California	507,711	512,525	520,357	526,167	534,074	541,953	549,804	557,629	565,426	573,197	580,943	588,693

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:						
	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11
Alameda	11,484	11,524	11,846	11,909	12,039	12,168	12,297	12,426	12,555	12,683	12,811
Contra Costa	7,806	7,966	8,033	8,176	8,307	8,438	8,569	8,701	8,834	8,967	9,101
Fresno	15,083	15,421	15,759	15,945	16,285	16,630	16,980	17,335	17,695	18,060	18,430
Kern	19,882	20,545	20,651	21,228	22,063	22,799	23,451	24,057	24,767	25,497	26,137
Los Angeles	190,693	192,167	193,788	195,614	197,768	199,905	202,025	204,129	206,216	208,286	210,340
Marin	5,030	5,072	5,115	5,180	5,277	5,377	5,482	5,592	5,706	5,825	5,949
Monterey	4,669	4,797	4,924	4,966	5,066	5,169	5,273	5,380	5,489	5,600	5,714
Orange	36,833	37,391	37,813	38,066	38,440	38,806	39,165	39,518	39,863	40,201	40,533
Placer	1,912	1,925	1,938	1,953	1,983	2,012	2,042	2,072	2,102	2,132	2,162
Riverside	37,480	37,980	38,131	38,487	38,893	39,295	39,693	40,086	40,475	40,860	41,241
Sacramento	10,016	10,067	10,122	10,174	10,290	10,404	10,515	10,625	10,731	10,836	10,938
San Bernardino	32,696	32,980	33,432	34,017	34,542	35,073	35,610	36,152	36,700	37,253	37,812
San Diego	29,577	29,883	30,226	30,516	30,892	31,265	31,637	32,005	32,371	32,735	33,097
San Francisco	6,723	6,811	6,989	6,989	7,129	7,274	7,425	7,580	7,741	7,908	8,080
San Joaquin	11,617	11,751	11,885	11,958	12,116	12,273	12,429	12,583	12,736	12,888	13,038
San Luis Obispo	1,823	1,862	1,902	1,926	1,963	2,001	2,039	2,078	2,118	2,158	2,199
San Mateo	5,544	5,644	5,744	5,744	5,834	5,926	6,020	6,115	6,213	6,313	6,414
Santa Barbara	6,266	6,365	6,464	6,526	6,617	6,710	6,804	6,898	6,995	7,092	7,190
Santa Clara	10,321	10,626	10,794	11,030	11,257	11,489	11,725	11,966	12,212	12,462	12,718
Santa Cruz	1,152	1,167	1,181	1,196	1,223	1,251	1,280	1,311	1,343	1,377	1,412
Solano	3,648	3,684	3,721	3,806	3,867	3,929	3,991	4,053	4,115	4,177	4,240
Sonoma	2,944	3,055	3,113	3,113	3,179	3,248	3,319	3,391	3,466	3,544	3,623
Ventura	7,522	7,699	7,877	7,877	8,032	8,191	8,353	8,519	8,689	8,862	9,039

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:											
	8/1	8/2	8/3	8/4	8/6				8/8				8/10			
Alameda	11,484	11,524	11,846	11,909	12,168	(2,434)	[584]	{292}	12,426	(2,485)	[596]	{298}	12,683	(2,537)	[609]	{304}
Contra Costa	7,806	7,966	8,033	8,176	8,438	(1,688)	[405]	{203}	8,701	(1,740)	[418]	{209}	8,967	(1,793)	[430]	{215}
Fresno	15,083	15,421	15,759	15,945	16,630	(3,326)	[798]	{399}	17,335	(3,467)	[832]	{416}	18,060	(3,612)	[867]	{433}
Kern	19,882	20,545	20,651	21,228	22,799	(4,560)	[1,094]	{547}	24,057	(4,811)	[1,155]	{577}	25,497	(5,099)	[1,224]	{612}
Los Angeles	190,693	192,167	193,788	195,614	199,905	(39,981)	[9,595]	{4,798}	204,129	(40,826)	[9,798]	{4,899}	208,286	(41,657)	[9,998]	{4,999}
Marin	5,030	5,072	5,115	5,180	5,377	(1,075)	[258]	{129}	5,592	(1,118)	[268]	{134}	5,825	(1,165)	[280]	{140}
Monterey	4,669	4,797	4,924	4,966	5,169	(1,034)	[248]	{124}	5,380	(1,076)	[258]	{129}	5,600	(1,120)	[269]	{134}
Orange	36,833	37,391	37,813	38,066	38,806	(7,761)	[1,863]	{931}	39,518	(7,904)	[1,897]	{948}	40,201	(8,040)	[1,930]	{965}
Placer	1,912	1,925	1,938	1,953	2,012	(402)	[97]	{48}	2,072	(414)	[99]	{50}	2,132	(426)	[102]	{51}
Riverside	37,480	37,980	38,131	38,487	39,295	(7,859)	[1,886]	{943}	40,086	(8,017)	[1,924]	{962}	40,860	(8,172)	[1,961]	{981}
Sacramento	10,016	10,067	10,122	10,174	10,404	(2,081)	[499]	{250}	10,625	(2,125)	[510]	{255}	10,836	(2,167)	[520]	{260}
San Bernardino	32,696	32,980	33,432	34,017	35,073	(7,015)	[1,684]	{842}	36,152	(7,230)	[1,735]	{868}	37,253	(7,451)	[1,788]	{894}
San Diego	29,577	29,883	30,226	30,516	31,265	(6,253)	[1,501]	{750}	32,005	(6,401)	[1,536]	{768}	32,735	(6,547)	[1,571]	{786}
San Francisco	6,723	6,811	6,989	6,989	7,274	(1,455)	[349]	{175}	7,580	(1,516)	[364]	{182}	7,908	(1,582)	[380]	{190}
San Joaquin	11,617	11,751	11,885	11,958	12,273	(2,455)	[589]	{295}	12,583	(2,517)	[604]	{302}	12,888	(2,578)	[619]	{309}
San Luis Obispo	1,823	1,862	1,902	1,926	2,001	(400)	[96]	{48}	2,078	(416)	[100]	{50}	2,158	(432)	[104]	{52}
San Mateo	5,544	5,644	5,744	5,744	5,926	(1,185)	[284]	{142}	6,115	(1,223)	[294]	{147}	6,313	(1,263)	[303]	{152}
Santa Barbara	6,266	6,365	6,464	6,526	6,710	(1,342)	[322]	{161}	6,898	(1,380)	[331]	{166}	7,092	(1,418)	[340]	{170}
Santa Clara	10,321	10,626	10,794	11,030	11,489	(2,298)	[551]	{276}	11,966	(2,393)	[574]	{287}	12,462	(2,492)	[598]	{299}
Santa Cruz	1,152	1,167	1,181	1,196	1,251	(250)	[60]	{30}	1,311	(262)	[63]	{31}	1,377	(275)	[66]	{33}
Solano	3,648	3,684	3,721	3,806	3,929	(786)	[189]	{94}	4,053	(811)	[195]	{97}	4,177	(835)	[201]	{100}
Sonoma	2,944	3,055	3,113	3,113	3,248	(650)	[156]	{78}	3,391	(678)	[163]	{81}	3,544	(709)	[170]	{85}
Ventura	7,522	7,699	7,877	7,877	8,191	(1,638)	[393]	{197}	8,519	(1,704)	[409]	{204}	8,862	(1,772)	[425]	{213}

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.