

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

Date: 8/7/20

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 8/7/20 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.

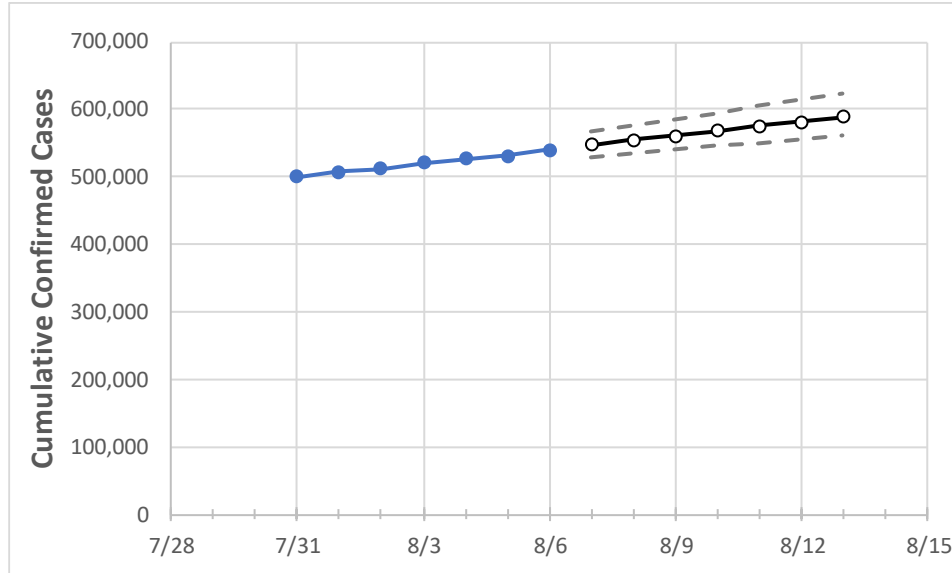
IEM's Modeling Lead

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:						
	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13
California	520,357	526,161	531,891	539,980	547,126	554,218	561,256	568,241	575,173	582,054	588,882

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:							
	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13	
Alameda	11,846	11,909	12,136	12,136	12,269	12,404	12,539	12,675	12,812	12,949	13,088	
Contra Costa	8,033	8,176	8,324	8,532	8,656	8,780	8,904	9,028	9,153	9,278	9,403	
Fresno	15,759	15,945	16,272	16,625	16,936	17,249	17,564	17,882	18,202	18,525	18,849	
Kern	20,651	21,228	21,433	21,724	22,275	22,661	23,039	23,484	23,871	24,313	24,719	
Los Angeles	193,788	195,614	197,912	201,106	203,176	205,228	207,260	209,275	211,271	213,248	215,207	
Marin	5,115	5,180	5,190	5,250	5,339	5,389	5,435	5,480	5,522	5,567	5,609	
Monterey	4,924	4,966	5,049	5,120	5,205	5,292	5,379	5,468	5,558	5,649	5,742	
Orange	37,813	38,066	38,131	38,711	38,974	39,227	39,470	39,704	39,929	40,145	40,352	
Placer	1,938	1,953	1,998	2,039	2,067	2,095	2,122	2,150	2,177	2,205	2,232	
Riverside	38,131	38,487	38,977	39,741	40,112	40,477	40,837	41,192	41,541	41,886	42,224	
Sacramento	10,122	10,174	10,244	10,544	10,635	10,722	10,807	10,888	10,967	11,042	11,115	
San Bernardino	33,432	34,017	34,237	34,635	35,037	35,437	35,833	36,226	36,616	37,003	37,387	
San Diego	30,226	30,516	30,864	31,127	31,427	31,722	32,011	32,294	32,572	32,845	33,112	
San Francisco	6,989	7,035	7,081	7,228	7,331	7,436	7,543	7,651	7,762	7,874	7,988	
San Joaquin	11,885	11,958	12,034	12,119	12,221	12,320	12,415	12,508	12,598	12,686	12,770	
San Luis Obispo	1,902	1,926	1,970	2,047	2,085	2,124	2,163	2,203	2,244	2,286	2,328	
San Mateo	5,744	5,751	5,758	5,891	5,937	5,981	6,025	6,069	6,111	6,153	6,194	
Santa Barbara	6,464	6,526	6,586	6,652	6,723	6,793	6,864	6,934	7,004	7,074	7,144	
Santa Clara	10,794	11,030	11,128	11,336	11,534	11,735	11,939	12,145	12,354	12,566	12,781	
Santa Cruz	1,181	1,196	1,205	1,213	1,232	1,252	1,272	1,293	1,314	1,336	1,358	
Solano	3,721	3,806	3,884	3,959	4,016	4,073	4,130	4,187	4,244	4,300	4,357	
Sonoma	3,113	3,161	3,208	3,208	3,268	3,329	3,391	3,455	3,520	3,586	3,654	
Ventura	7,877	7,915	7,953	7,953	8,062	8,171	8,281	8,390	8,500	8,610	8,721	

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:											
	8/3	8/4	8/5	8/6	8/8		8/10		8/12							
Alameda	11,846	11,909	12,136	12,136	12,404	(2,481)	[595]	{298}	12,675	(2,535)	[608]	{304}	12,949	(2,590)	[622]	{311}
Contra Costa	8,033	8,176	8,324	8,532	8,780	(1,756)	[421]	{211}	9,028	(1,806)	[433]	{217}	9,278	(1,856)	[445]	{223}
Fresno	15,759	15,945	16,272	16,625	17,249	(3,450)	[828]	{414}	17,882	(3,576)	[858]	{429}	18,525	(3,705)	[889]	{445}
Kern	20,651	21,228	21,433	21,724	22,661	(4,532)	[1,088]	{544}	23,484	(4,697)	[1,127]	{564}	24,313	(4,863)	[1,167]	{584}
Los Angeles	193,788	195,614	197,912	201,106	205,228	(41,046)	[9,851]	{4,925}	209,275	(41,855)	[10,045]	{5,023}	213,248	(42,650)	[10,236]	{5,118}
Marin	5,115	5,180	5,190	5,250	5,389	(1,078)	[259]	{129}	5,480	(1,096)	[263]	{132}	5,567	(1,113)	[267]	{134}
Monterey	4,924	4,966	5,049	5,120	5,292	(1,058)	[254]	{127}	5,468	(1,094)	[262]	{131}	5,649	(1,130)	[271]	{136}
Orange	37,813	38,066	38,131	38,711	39,227	(7,845)	[1,883]	{941}	39,704	(7,941)	[1,906]	{953}	40,145	(8,029)	[1,927]	{963}
Placer	1,938	1,953	1,998	2,039	2,095	(419)	[101]	{50}	2,150	(430)	[103]	{52}	2,205	(441)	[106]	{53}
Riverside	38,131	38,487	38,977	39,741	40,477	(8,095)	[1,943]	{971}	41,192	(8,238)	[1,977]	{989}	41,886	(8,377)	[2,011]	{1,005}
Sacramento	10,122	10,174	10,244	10,544	10,722	(2,144)	[515]	{257}	10,888	(2,178)	[523]	{261}	11,042	(2,208)	[530]	{265}
San Bernardino	33,432	34,017	34,237	34,635	35,437	(7,087)	[1,701]	{850}	36,226	(7,245)	[1,739]	{869}	37,003	(7,401)	[1,776]	{888}
San Diego	30,226	30,516	30,864	31,127	31,722	(6,344)	[1,523]	{761}	32,294	(6,459)	[1,550]	{775}	32,845	(6,569)	[1,577]	{788}
San Francisco	6,989	7,035	7,081	7,228	7,436	(1,487)	[357]	{178}	7,651	(1,530)	[367]	{184}	7,874	(1,575)	[378]	{189}
San Joaquin	11,885	11,958	12,034	12,119	12,320	(2,464)	[591]	{296}	12,508	(2,502)	[600]	{300}	12,686	(2,537)	[609]	{304}
San Luis Obispo	1,902	1,926	1,970	2,047	2,124	(425)	[102]	{51}	2,203	(441)	[106]	{53}	2,286	(457)	[110]	{55}
San Mateo	5,744	5,751	5,758	5,891	5,981	(1,196)	[287]	{144}	6,069	(1,214)	[291]	{146}	6,153	(1,231)	[295]	{148}
Santa Barbara	6,464	6,526	6,586	6,652	6,793	(1,359)	[326]	{163}	6,934	(1,387)	[333]	{166}	7,074	(1,415)	[340]	{170}
Santa Clara	10,794	11,030	11,128	11,336	11,735	(2,347)	[563]	{282}	12,145	(2,429)	[583]	{291}	12,566	(2,513)	[603]	{302}
Santa Cruz	1,181	1,196	1,205	1,213	1,252	(250)	[60]	{30}	1,293	(259)	[62]	{31}	1,336	(267)	[64]	{32}
Solano	3,721	3,806	3,884	3,959	4,073	(815)	[195]	{98}	4,187	(837)	[201]	{100}	4,300	(860)	[206]	{103}
Sonoma	3,113	3,161	3,208	3,208	3,329	(666)	[160]	{80}	3,455	(691)	[166]	{83}	3,586	(717)	[172]	{86}
Ventura	7,877	7,915	7,953	7,953	8,171	(1,634)	[392]	{196}	8,390	(1,678)	[403]	{201}	8,610	(1,722)	[413]	{207}

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.