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

Date: 10/20/21

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 10/20/21 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.

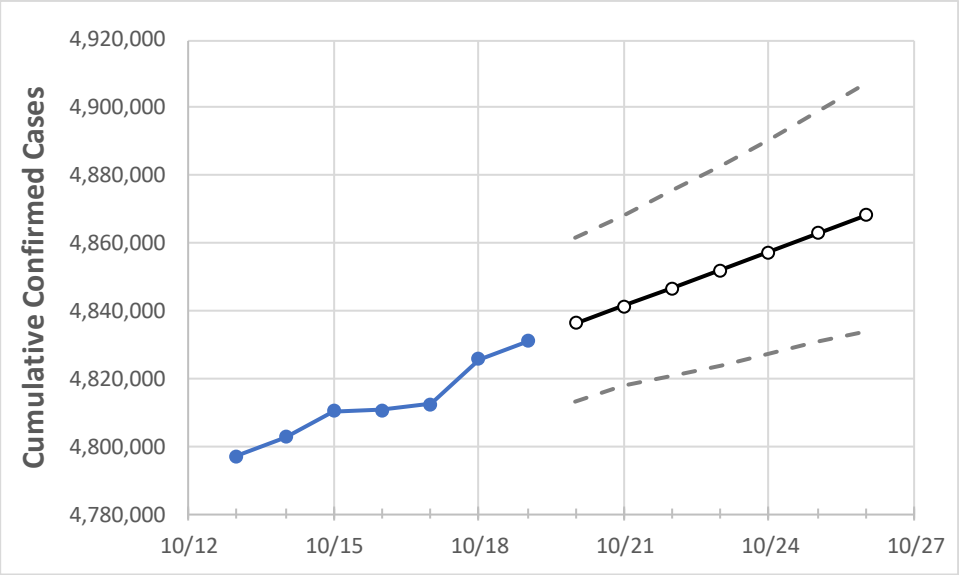
IEM's Modeling Lead

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:						
	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26
California	4,810,682	4,812,309	4,825,708	4,830,872	4,836,391	4,841,404	4,846,718	4,851,931	4,857,377	4,862,818	4,868,216

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 10%, and are often within 5%, of actual confirmed cases.

California Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26
Alameda	120,019	120,151	120,283	120,366	120,480	120,594	120,704	120,814	120,923	121,038	121,143
Contra Costa	99,360	99,486	99,612	99,712	99,829	99,945	100,053	100,168	100,284	100,395	100,506
Fresno	144,455	144,787	145,119	145,378	145,697	146,017	146,329	146,652	146,973	147,309	147,624
Kern	144,402	144,658	144,914	145,227	145,548	145,856	146,168	146,483	146,799	147,120	147,425
Lake	6,526	6,545	6,565	6,583	6,599	6,615	6,632	6,648	6,664	6,680	6,695
Los Angeles	1,476,243	1,476,791	1,477,686	1,479,421	1,480,383	1,481,327	1,482,263	1,483,203	1,484,114	1,485,016	1,485,961
Marin	17,602	17,623	17,644	17,665	17,682	17,699	17,715	17,732	17,749	17,765	17,781
Monterey	50,721	50,747	50,772	50,792	50,820	50,846	50,873	50,898	50,925	50,947	50,974
Orange	322,963	323,185	323,407	323,569	323,765	323,958	324,142	324,332	324,513	324,695	324,874
Placer	38,974	39,046	39,118	39,157	39,229	39,303	39,370	39,442	39,512	39,583	39,650
Riverside	369,699	370,054	370,409	370,608	370,912	371,208	371,491	371,788	372,068	372,342	372,616
Sacramento	157,893	158,165	158,437	158,785	159,051	159,326	159,597	159,865	160,140	160,415	160,686
San Bernardino	356,684	357,052	357,421	357,639	357,929	358,222	358,501	358,780	359,061	359,346	359,612
San Diego	364,104	364,634	364,912	365,253	365,646	366,029	366,423	366,797	367,184	367,568	367,929
San Francisco	54,094	54,157	54,220	54,266	54,331	54,398	54,463	54,528	54,591	54,656	54,717
San Joaquin	101,955	102,102	102,250	102,341	102,469	102,599	102,727	102,849	102,975	103,099	103,221
San Luis Obispo	29,701	29,749	29,797	29,837	29,874	29,911	29,948	29,985	30,021	30,055	30,092
San Mateo	53,875	53,923	53,970	54,023	54,070	54,115	54,160	54,206	54,250	54,296	54,341
Santa Barbara	44,892	44,949	45,005	45,047	45,102	45,157	45,211	45,265	45,319	45,375	45,427
Santa Clara	144,680	144,842	145,004	145,127	145,279	145,430	145,578	145,730	145,877	146,028	146,181
Santa Cruz	20,883	20,906	20,928	20,943	20,964	20,983	21,004	21,023	21,042	21,061	21,080
Solano	45,807	45,852	45,898	45,934	45,975	46,014	46,053	46,090	46,128	46,164	46,200
Sonoma	40,748	40,785	40,822	40,865	40,911	40,958	41,003	41,048	41,094	41,140	41,187
Ventura	100,616	100,709	100,801	100,849	100,937	101,027	101,112	101,201	101,286	101,374	101,455

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:		
	10/16	10/17	10/18	10/19	10/21	10/23	10/25
Alameda	120,019	120,151	120,283	120,366	120,594 (24,119) [5,789] {2,894}	120,814 (24,163) [5,799] {2,900}	121,038 (24,208) [5,810] {2,905}
Contra Costa	99,360	99,486	99,612	99,712	99,945 (19,989) [4,797] {2,399}	100,168 (20,034) [4,808] {2,404}	100,395 (20,079) [4,819] {2,409}
Fresno	144,455	144,787	145,119	145,378	146,017 (29,203) [7,009] {3,504}	146,652 (29,330) [7,039] {3,520}	147,309 (29,462) [7,071] {3,535}
Kern	144,402	144,658	144,914	145,227	145,856 (29,171) [7,001] {3,501}	146,483 (29,297) [7,031] {3,516}	147,120 (29,424) [7,062] {3,531}
Lake	6,526	6,545	6,565	6,583	6,615 (1,323) [318] {159}	6,648 (1,330) [319] {160}	6,680 (1,336) [321] {160}
Los Angeles	1,476,243	1,476,791	1,477,686	1,479,421	1,481,327 (296,265) [71,104] {35,552}	1,483,203 (296,641) [71,194] {35,597}	1,485,016 (297,003) [71,281] {35,640}
Marin	17,602	17,623	17,644	17,665	17,699 (3,540) [850] {425}	17,732 (3,546) [851] {426}	17,765 (3,553) [853] {426}
Monterey	50,721	50,747	50,772	50,792	50,846 (10,169) [2,441] {1,220}	50,898 (10,180) [2,443] {1,222}	50,947 (10,189) [2,445] {1,223}
Orange	322,963	323,185	323,407	323,569	323,958 (64,792) [15,550] {7,775}	324,332 (64,866) [15,568] {7,784}	324,695 (64,939) [15,585] {7,793}
Placer	38,974	39,046	39,118	39,157	39,303 (7,861) [1,887] {943}	39,442 (7,888) [1,893] {947}	39,583 (7,917) [1,900] {950}
Riverside	369,699	370,054	370,409	370,608	371,208 (74,242) [17,818] {8,909}	371,788 (74,358) [17,846] {8,923}	372,342 (74,468) [17,872] {8,936}
Sacramento	157,893	158,165	158,437	158,785	159,326 (31,865) [7,648] {3,824}	159,865 (31,973) [7,674] {3,837}	160,415 (32,083) [7,700] {3,850}
San Bernardino	356,684	357,052	357,421	357,639	358,222 (71,644) [17,195] {8,597}	358,780 (71,756) [17,221] {8,611}	359,346 (71,869) [17,249] {8,624}
San Diego	364,104	364,634	364,912	365,253	366,029 (73,206) [17,569] {8,785}	366,797 (73,359) [17,606] {8,803}	367,568 (73,514) [17,643] {8,822}
San Francisco	54,094	54,157	54,220	54,266	54,398 (10,880) [2,611] {1,306}	54,528 (10,906) [2,617] {1,309}	54,656 (10,931) [2,624] {1,312}
San Joaquin	101,955	102,102	102,250	102,341	102,599 (20,520) [4,925] {2,462}	102,849 (20,570) [4,937] {2,468}	103,099 (20,620) [4,949] {2,474}
San Luis Obispo	29,701	29,749	29,797	29,837	29,911 (5,982) [1,436] {718}	29,985 (5,997) [1,439] {720}	30,055 (6,011) [1,443] {721}
San Mateo	53,875	53,923	53,970	54,023	54,115 (10,823) [2,598] {1,299}	54,206 (10,841) [2,602] {1,301}	54,296 (10,859) [2,606] {1,303}
Santa Barbara	44,892	44,949	45,005	45,047	45,157 (9,031) [2,168] {1,084}	45,265 (9,053) [2,173] {1,086}	45,375 (9,075) [2,178] {1,089}
Santa Clara	144,680	144,842	145,004	145,127	145,430 (29,086) [6,981] {3,490}	145,730 (29,146) [6,995] {3,498}	146,028 (29,206) [7,009] {3,505}
Santa Cruz	20,883	20,906	20,928	20,943	20,983 (4,197) [1,007] {504}	21,023 (4,205) [1,009] {505}	21,061 (4,212) [1,011] {505}
Solano	45,807	45,852	45,898	45,934	46,014 (9,203) [2,209] {1,104}	46,090 (9,218) [2,212] {1,106}	46,164 (9,233) [2,216] {1,108}
Sonoma	40,748	40,785	40,822	40,865	40,958 (8,192) [1,966] {983}	41,048 (8,210) [1,970] {985}	41,140 (8,228) [1,975] {987}
Ventura	100,616	100,709	100,801	100,849	101,027 (20,205) [4,849] {2,425}	101,201 (20,240) [4,858] {2,429}	101,374 (20,275) [4,866] {2,433}

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.